LARYNGOSCOPE.

Vol. XLII

JULY, 1932.

No. 7

APPARATUS USED IN THE RECENT BALTIMORE EXPERIMENTS ON THE PHYSIOLOGY OF THE EAR.*

E. G. WITTING, Baltimore.

The experimental work of Wever and Bray¹, which showed that changes in electrical potential in the auditory nerve may be amplified and the sound stimulus reproduced, suggested the possibility of using this method to study the physiology of the middle and inner ear. Several reports² on the experiments made at the Otological Research Laboratory indicate the value of the method but give no detailed description of the electrical equipment employed. This report describes the apparatus used in the preliminary experiments during the year 1930-31, and the changes and additions during the past year, which make the observations more accurate and convincing.

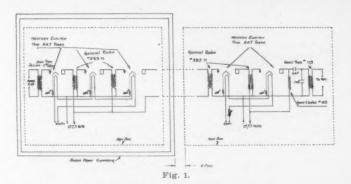
EQUIPMENT USED IN THE 1930-31 EXPERIMENTS.

The electrical equipment used in the experiments during the first year of our work was as simple as possible. The arrangement of apparatus closely followed that used by Wever and Bray. The animal or operating room and the amplifier or observing room were separated by 60 feet. Two electrodes, active and inactive, were con-

^oFrom the Otological Research Laboratory and the Surgical Hunterian Laboratory of the Johns Hopkins University.

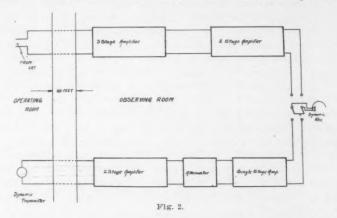
Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, June 9, 1932.

nected by a cable to the input end of a vacuum tube amplifier. The cable was specially shielded to reduce the effect of stray electric fields. An ordinary watch-case type telephone receiver, or a loud speaker, was connected to the output of the amplifier. Fig. 1 shows the details of the amplifier. Five stages of transformer-coupled amplification were necessary; this corresponds to a power amplification of approximately 10¹⁰ (ten billion times), meaning that when all of the available amplification was used, the electric power in the telephone receiver was approximately ten billion times the power applied to the input of the amplifier in the form of changing potentials in the auditory nerve. It is to be noted that the vacuum tubes are of the type designed for use with alternating current filament supply, but are operated with direct current. The use of alternating current in such an amplifier would produce an objectionable hum in the



receiver, but the AC tubes were employed instead of DC in an attempt to reduce the amount of "hiss" always present in a vacuum tube amplifier. In addition, certain advantages in shielding from disturbances arose as a result of the cathode (the element common to both input and output of the tube) of the tube being free from the battery. The use of a transformer on the input of the amplifier renders the antenna effect of the long connecting cable to the amplifier less troublesome. If no transformer is used, and the electrodes slip out of contact with the animal, loud crackling and buzzing sounds are heard in the receiver, resulting in discomfort to the observer and the possibility of injury to a delicate receiver. The primary of the transformer used may not contain the optimum condition for connection to the cat, but since satisfactory results were obtained no effort was made to determine the best value of input transformer.

This transformer, which was designed to operate into a vacuum tube (and hence has the secondary winding made to correspond to the input of the tube) has a winding ratio of 4 to 1. It is probable that a somewhat higher ratio would more nearly approach the optimum. As a result of using such an extremely sensitive amplifier two types of disturbance were experienced—electrical and acoustic. To eliminate the effect of stray electric and magnetic fields in the building, the 60-foot cable from the operating room to the apparatus was shielded by means of a lead covering, and the amplifier was enclosed in iron boxes which were connected to earth. In the case of a highgain amplifier, if the electrical power received from the amplifier is induced back into the input circuit of the amplifier it is reamplified and a continuous howl or other severe disturbance is set up. The



isolation of the output and input currents may be accomplished in several ways. In the present case the amplifier as a whole was divided into two separate units, three tubes in the first unit and two in the second. Each unit was housed in an iron box and separated by about 6 feet. In addition, separate batteries were used on the two units. These precautions eliminated electrical "feed back." The acoustical disturbance mentioned above was due to the vibration of the vacuum tubes in the first unit. When these tubes vibrate, either by mechanical transmission through the building or by acoustical transmission, a severe, continuous "bong" is heard in the receivers. This was eliminated by enclosing the iron box containing the first unit in a double-box arrangement. The iron box rested on pneumatic pads in an inner box, which was lined on its outside with sound-absorbing material.

This box, in turn, was placed on pneumatic pads in a larger box, lined inside with the same kind of sound-absorbing material. Thus there was no solid mechanical connection between the inner and outer boxes and the pneumatic pads absorbed all mechanical vibrations.

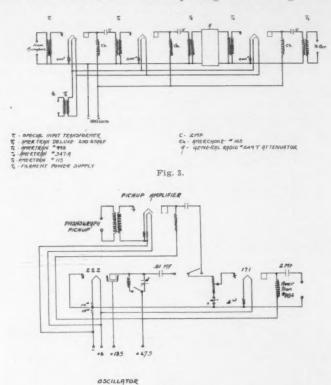
ADDITIONAL EQUIPMENT USED IN THE 1931-32 EXPERIMENTS.

Although the observations made with this apparatus were purely qualitative and easily influenced by subjective impressions, the changes in the transmission of sound that resulted from experimental lesions of the ossicles or round window membrane were so convincing and so constant that the need for an accurate method of measurement soon became imperative. The method adopted and in use at the present time was suggested by Dr. Harvey Fletcher, of the Bell Telephone Laboratories, and is based on the principle of comparison of the sound passing through the animal's ear with that coming through a second system, consisting of a microphone, amplifier and calibrated attenuator*, which is entirely independent of the animal system. The general arrangement is indicated in Fig. 2. The dynamic receiver indicated in the diagram is attached to a head band and worn by the observer. The sounds used to stimulate the auditory nerve are impressed simultaneously on the tympanic membrane of the animal and on a special dynamic microphone. By throwing the switch from the animal circuit to the microphone circuit the observer can compare the intensity, and by adding attenuation equalize or bring the two sounds into "balance." The attenuator is calibrated in decibels and when a balance is established the decibel value of the sound passing through the animal's ear is known and may be charted for each frequency employed and used for comparison after various

[&]quot;The attenuator consists of a certain arrangement of resistances so that some of the amplifier power is dissipated, reducing the power applied to the telephone receiver and hence reducing the volume of sound produced by the receiver. By means of key-switches the amount of power dissipated can be controlled, and knowing the relation between the power before and after dissipation, the decrease in sound due to the attenuation can be determined. This relation is expressed in a unit known as the decibel, for which the following will serve as an explanation. It might be sufficient in describing the relationship between two different loudnesses of a sound under one condition, we could express the relationship as 2 of some unit; if the second sound was 6 times the intensity of the same sound under express it as 8 of the units. The intensity of the first one, we could express it is 6 of the units. The intensity of the first one, we could express it is 6 of the units. The intensity range of perception of the human ear for tones of some pitches is in the ratio of about ten million millions; that is, the loudest volume of certain pitches that can be heard by the ear contains ten million million times as much accoustic power as the lowest perceptible volume of those pitches, and the use of mere ratio units would be quite cumbersome. However, if a unit which is the common logarithm of that ratio is used, we have as the logarithm of the ten million million situants, 13 units, a much more convenient way of expressing the change corresponding to this enormous ratio. The unit is the bel; the logarithm of the ratio of two intensities. Thus if a sound is increased by one bel, its intensity is increased one hundred times, et cetera. The unit mentioned throughout this article is the decibel, one-tenth of the bel, and has the same value as the sensation unit used on audiometer scales, so that a change in hearing of 10 sensation units so a change of 10 decibels.

experimental lesions in the animal's ear. In other words, a well trained observer is thus enabled to plot a curve for the transmission of speech and pure tones with an accuracy that compares favorably with the clinical audiometer chart.

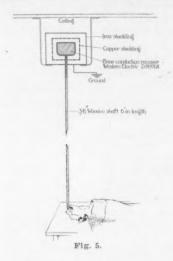
The comparison amplifier, as shown schematically in Fig. 3, consists of three tubes, the filaments operating on alternating current.



It is possible to use alternating current supply for the filaments here because the small amount of amplification necessary does not cause an objectionable hum in the receivers. As in the amplifier connected to the animal, a lead-sheathed cable connects the microphone in the operating room with the amplifier in the observing room. In the qualitative (1930-31) measurements, the spoken voice, tuning forks and whistles were employed as sound sources. Obviously these are

Fig. 4.

inadequate since a prolonged, constant sound is required in making a "balance" of volume with the two systems. A series of tones may be obtained somewhat crudely by playing constant note phonograph records on an acoustic phonograph, the sound being received by both the ear of the cat and the microphone. This method was used at first but was later supplanted by an electrical oscillator which generates the desired tones and has the advantage of being more constant in frequency and more flexible both as to frequency and volume. The tones are of reasonable purity. Fig. 4 shows a schematic of this oscillator, a modification of one described in the Decem-



ber, 1930, issue of *Electronics*. This oscillator is quite adequate for the purpose and may be built at a small cost.

A means of obtaining a speech test is provided in the form of a special volume-testing record made by Bell Telephone Laboratories. The sentence, "Joe took father's shoe bench out, she is waiting at my lawn," is repeated throughout the record at exactly the same intensity, so that a comparison can be made by listening to the sentence first through one system and then through the other. This seemingly meaningless sentence was chosen by those responsible for making the record because it includes the majority of English speech sounds.

The use of an electrical oscillator necessitates a telephone receiver to produce the sound. Two telephone receivers connected in series are used, one producing the sound in the ear of the cat, the other working into the microphone of the comparison system. Severe induction due to the magnetic field of the first receiver was experienced, and even after being completely shielded by an iron box it was necessary to remove it about 6 feet from the animal and use a rubber tube for transmitting the sound to the animal's ear. Ordinary garden hose about three-quarters of an inch in diameter has proven quite satisfactory for frequencies up to 8,000 cycles. The bell of a stethoscope is inserted into the hose and the two tubes placed in the external auditory canals of the animal. By clamping these tubes the sound is directed to the ear to be tested. The quality of the sound from the tube and that from an open receiver is quite different, so in order to facilitate the balancing of the sounds through the two circuits a

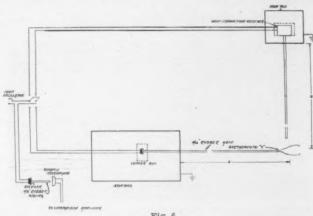


Fig. 6.

short length of small-diameter rubber tubing was attached to the receiver placed in front of the microphone. Although the separation of the receiver and the animal by 6 feet and the careful shielding of the receiver eliminates most of the magnetic interference, it is, however, necessary to make tests during each experiment to determine whether or not any of the sound in the animal system is due to this magnetic interference.

Bone conduction measurements are made by replacing the receiver and tube leading to the external auditory canal of the animal with a Western Electric D-80904 bone-conduction receiver. Here again, interference was experienced, making it necessary to move the receiver about 6 feet away and shield it with an iron box. A 3/6-inch

diameter wooden shaft is used to transmit the vibration from the receiver to the head of the animal. For convenience the receiver is suspended just below the ceiling of the operating room and directly above the operating table. The shaft may be unscrewed from the receiver and removed when not in use. Fig. 5 shows the arrangement of the bone conduction receiver in use. Fig. 6 shows the circuit connection of both the air and bone conduction apparatus.

As an example of the use of this apparatus, the protocol of an experiment, in which the effect of puncturing the round window membrane on air and bone conduction was observed, is given below. Fig. 7 shows the chart plotted from the data. The marked difference between the effect on air and bone conduction is clearly shown. The difference, in decibels, between the two curves indicates the loss due to the puncture. It is to be observed that the air conduction (solid lines) undergoes no appreciable change.

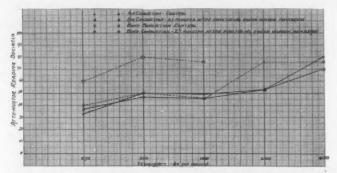


Fig. 7. Chart showing effect on air and bone conduction of puncturing the round window membrane. The ordinates represent the settings of the attenuator for the "balance" of the tones through the cat and through the comparison amplifier.

EXPERIMENT NO. 166.

May 10, 1932. Ether started 2:15 p. m. Animal sacrificed 5 p. m. Experiment: Effect of puncturing round window membrane on AC and BC, left.

P. E. of Cat: Medium-sized, tiger and white, in good condition. Anesthesia: Intratracheal ether.

Surgeon: Dr. Crowe.

Procedure: The animal was prepared for test in usual manner, an electrode being placed on the left auditory nerve. The left bulla was opened, exposing the round window. Control tests were made, after which the membrane was punctured with a needle, care being

taken not to injure any of the intracochlear structures. A very small amount of fluid was lost after this procedure. Tests were made at intervals for 45 minutes. An attempt was then made to plug the round window with wax but this was not particularly successful and it was suspected that some damage had been done to the cochlea in this procedure. The animal was in good condition throughout the entire experiment.

Procedure	Time	Frequency					
		250	500 Attenu	1000 ation—L	2000 Decibels	4000	
Control, AC	2:50	33	50	49	53	80	
Control, BC		40	50	46	76	76	
Membrane punctured	3:10						
AC		30	45	43	50	80	
BC		60	70	67	80	_	
AC	3:15	37	47	46	53	70	
BC	3:20	60	80	76	_	_	
Test for pick-up, AC	**		-	_		_	
Test for pick-up, BC			_	-		_	
AC	3:30	37	53	51	53	70	
BC		_	70	80	_	80	
AC	3:45	37	49	56	58	. 73	
BC	ine.		60	_		-	

BIBLIOGRAPHY.

- 1. WEVER, E. G., and BRAY, C. W.: The Nature of Acoustic Response: The Relation Between Sound Frequency and Frequency of Impulses in the Auditory Nerve. *Jour. Exper. Psychol.*, 13:5, Oct., 1930.
- 2. Hughson, Walter, and Crowe, S. J.: Function of the Round Window: An Experimental Study. *Jour. A. M. A.*, June, 1931, Vol. 96, pp. 2027-2028.
- Crowe, S. J.; Hughson, Walter, and Witting, E. G.: Function of the Tensor Tympani Muscle: An Experimental Study. *Arch. of Otolaryngology*, Nov., 1931, Vol. 14, pp. 575-580.
- CROWE, S. J., and HUGHSON, WALTER: Eine neue Methode zur Untersuchung der Physiologie und Pathologie des Ohres. Zeitschrift für Hals-, Nasen- und Ohrenheilkunde, Band 30, 1931, pp. 65-76.

FUNCTIONAL EAR EXAMINATION IN TUMORS OF THE ACOUSTIC NERVE. REPORT OF CASES.*†

Dr. Page Northington, New York.

It seems worth while to report this small group of cases as an opportunity is offered to reassert the early symptoms of tumors of the acoustic nerve, to cite the consistent impairment of the reactions of the acoustic nerve on the side of the lesion, and to report findings in the verified cases which are at variance with those commonly maintained as diagnostic of a cerebellopontile angle tumor,

This report includes the functional examination of eight patients that had a preoperative diagnosis of unilateral acoustic nerve tumor. All of these patients were operated on. The diagnosis was confirmed in five cases and no tumor was found involving the acoustic nerve in three cases. In evaluating the contents of this report, attention is invited especially to:

1. The duration of the ear manifestations before the diagnosis was made.

2. The results of the rotation tests in determining the presence of vestibular impairment on the side of the tumor.

3. The results of the caloric tests in the verified and unverified cases.

4. The comparison of the functional impairment of the cochlear and vestibular nerve on the side of the tumor.

The first five charts are from the examination of patients whose diagnosis of tumor of the acoustic nerve was verified at operation.

Case 1: N. I. 3210, female, age 20 years. Ear Symptoms: Deafness and tinnitus in the right ear for one year. Patient stated that in two weeks from the first time she had any deafness, her hearing was entirely gone. Attacks of slight vertigo.

Examination: 1. There was a spontaneous nystagmus to the left. 2. There were differences in the amplitude and speed of the nystagmus following right and left rotation. The after-rotary nystagmus time was normal. The past-pointing was good. The vertigo was shortened. 3. The caloric tests showed a total loss of the vestibular reactions on the side of the tumor and an impaired reaction on the

^{*}Read at the meeting of the New York Academy of Medicine, Section of Otolaryngology, Feb. 17, 1932.

tfrom the Department of Otolaryngology, Columbia University. One case is from the Neurological Service, Bellevue Hospital, N. Y., and seven cases are from the New York Neurological Institute. The operations were performed by the neurological surgeons of these hospitals.

opposite side. 4. An audiometric test was not done. The hearing was moderately impaired in both ears, as determined by the voice test. The impairment was greater in the right ear, the side of the tumor.

Case 2: N. I. 10508, male, age 29 years. Ear Symptoms: Deafness and tinnitus in the left ear for one-and-a-half years. Attacks of slight vertigo.

Examination: 1. There was a spontaneous nystagmus to the right. 2. The rotation tests showed nothing abnormal except possibly a shortening of vertigo time. 3. The caloric tests of the right ear showed active, normal reactions. Of the left ear there was possibly

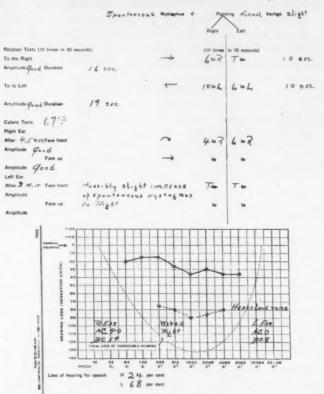
	SportAHEULE	Hystogewa	-> 7-	Nonelu	No open
			whom	7	
Retation Tosts (10 times in 20 seco	oredo)		(18 times	in 10 seconds)	
To the Right		\rightarrow	4 1079	2 47	7366
Amplitude Duration Louge And Rap-L	21 306				
To to Left		\leftarrow	3 1.L	a u L	6 340
Argura M And Stow Argurated Duration	19 566				
Calone Yests 67°F					
Roger Eur			-	_	
After 5 19 Fem front Amplitude	•	KOKE	Tow	100	
Face up		MONE	10	to .	
Aihplitude				1	
After / Mind Face front		5	T-	Tw	
Amplitude FAIR					
Face op		K	No.	lo .	
Amplitude Good					
	- D				
HEA. IN	g: Right EAR . N	MISPERE	onal vois	e. 18+	
Heari	re: Left EAR .			28+	

a slight increase in the spontaneous nystagmus present. 4. There was a small impairment of hearing in the right ear and marked deafness in the left, the side of the tumor.

Case 3: B. H., brain tumor 16, male, age 21 years. Ear Symptoms: Deafness and tinnitus in the left ear for two-and-a-half years. At times the tinnitus was in both ears. Attacks of slight vertigo.

Examination: 1. There was a spontaneous nystagmus to the left. Slight vertigo. 2. The rotation tests showed an unequal after-rotary nystagmus time that suggested impaired vestibular function on the left, the side of the tumor. Past-pointing was present. 3. The

caloric tests showed considerable impairment of the vestibular reactions on the right side, in the face front position. There was a total loss of vestibular reactions in both the face front and face up positions on the left, the side of the tumor. 4. No audiometric test was done. The hearing was very good in the right ear and slightly impaired in the left, the side of the tumor, as determined by voice test.



Case 4: N. I. 10307, female, age 30 years. Ear Symptoms: Progressive deafness with tinnitus in the right ear for three-and-a-half years. No vertigo at any time.

Examination: 1. There was no spontaneous nystagmus, past-pointing or vertigo. 2. The rotation tests showed impaired vestibular reactions, though nothing to indicate that there was a unilateral lesion of the vestibular nerve. 3. The caloric tests showed a total loss of

vestibular reactions on the right, the side of the tumor, and an impaired reaction on the opposite side. 4. The hearing was greatly impaired on the right side of the tumor, and very good in the left ear.

A record of this patient was available showing the audiogram and results of rotation tests that were done two-and-a-half years ago. The audiogram showed almost exactly the same loss of hearing as recorded here. The results of the rotation tests also showed about the same findings as of the later date. Caloric tests at the time of the original examination, two-and-a-half years ago, would probably have suggested the correct diagnosis and prompted a thorough neurological investigation at that time.

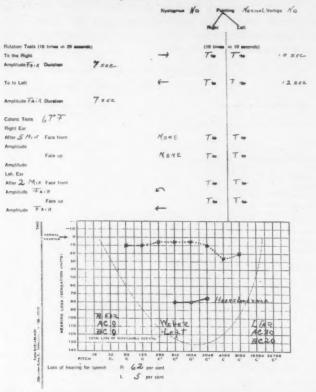
	Sporteresus	Hystephus 4	- 7	one Mount wow Slight
Potation Tools (10 times in 20 second	lin)		(10 towns	
To the Right			3 . 1	2.2
Ampiriude Good Ourston -	15000			
To to Lalt		4	2-4	2-4
Ampirouse Go and Durasian	25 see			
Cuteric Years 67° F.				
Right Ear				
Miss 3.5 Meri Face trust		a	T	T-
Amplitude Pes 2			T-	
Fase up		\rightarrow	T do	
Ampinude Good				
oft Ear				
Mitter 5 Mint Face trent		None	T	T
brigation		None		
Face up		KONE	to	16
Amplitude				
# CANING	Right EAR . W	hospiard s	10162 1	5° 10° 11 32
	, A	C 33 F	JC 20	
Heading.	Left LAR. Y	Whispeard	40 C.	3 6084 128

Case 5: N. I. 9679, female, age 42 years. Ear Symptoms: Deafness and tinnitus in the left ear for seven years. A sensation of dizziness at times.

Examination: 1. There was a spontaneous nystagmus on looking up and looking left. No past-pointing. Slight vertigo. 2. The rotation tests showed an unequal after-rotary nystagmus time following right and left rotation that suggested a marked vestibular impairment on the side opposite that of the tumor, which would have been misleading without the caloric test or the hearing tests. Good past-pointing was present. The vertigo was in the wrong direction.

3. The caloric tests showed marked impairment of vestibular reactions on the right side and a total loss on the left, the side of the tumor. 4. The hearing was good in the right ear and poor in the left, the side of the tumor.

The three remaining charts are from the examination of patients that also had a diagnosis of tumor of the acoustic nerve but the diagnosis was not verified on operation.

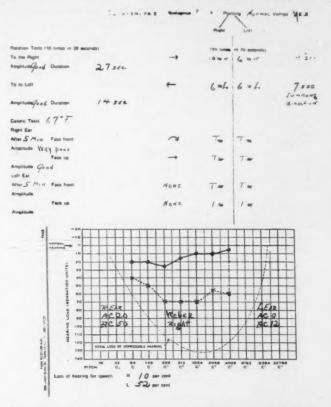


Case 6: N. I. 2359, male, age 39 years. Suspected tumor of the right acoustic nerve. Ear Symptoms: Deafness and bilateral tinnitus for two years. Spells of vertigo with nausea and vomiting. Falling to the right.

Examination: 1. There was no spontaneous nystagmus or pastpointing present. There was marked vertigo. 2. The rotation and vestibular tests showed an increased irritability of both vestibular nerves. The responses were normal in type. 3. The hearing was moderately impaired in both ears.

Case 7: N. I. 1970, male, age 40 years. Suspected tumor of right acoustic nerve. Ear Symptoms: Deafness and tinnitus in left ear for two years. Spells of vertigo with nausea and vomiting.

Examination: 1. There was spontaneous nystagmus in upward direction. 2. The rotation tests showed an impaired nystagmus re-

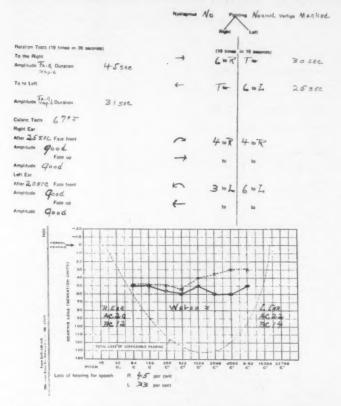


sponse, but good past-pointing. 3. The caloric tests showed only a moderate impairment of the vestibular reaction on the side of the suspected tumor. 4. The hearing was impaired on both sides, in the right more than in the left ear.

Case 8: N. I. 1675, male, age 43 years. Suspected tumor of left acoustic nerve. Ear Symptoms: Deafness and tinnitus. Vertigo with

attack of nausea and vomiting for six years. There was a history of left middle ear infection in childhood and no recurrence.

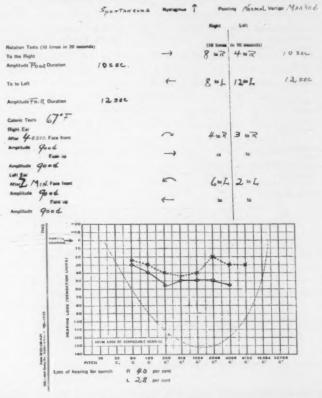
Examination: 1. There was a spontaneous nystagmus to the left, and past-pointing. The vertigo was marked. 2. The rotation tests showed an impaired nystagmus reaction but good past-pointing and vertigo. 3. The caloric tests showed good reaction on the right side,



but marked impairment on the left, the side of the suspected tumor. 4. The hearing was impaired in both ears, chiefly in the upper tones, in the left more than in the right ear.

The early subjective disturbances of acoustic nerve tumors are almost invariably deafness and tinnitus, and at times vertigo. Ever since the work of Cushing¹ and others, there is a general agreement that the ear symptoms are the inaugural manifestations of tumors of the acoustic nerve.

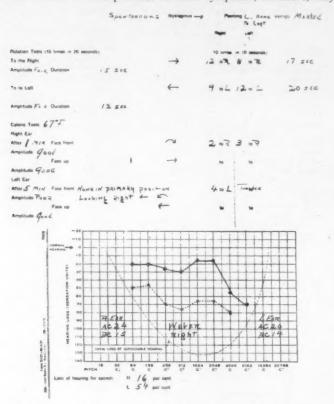
In the cases reported here there was usually a duration of years before structures in the posterior fossa were sufficiently involved to cause the appearance of any additional subjective signs of an intracranial tumor. The duration of the ear symptoms was from one to six years, the average being three years before a diagnosis of



acoustic nerve tumor was made. Deafness was consistently accompanied by tinnitus. The tinnitus was described as a hissing, buzzing or roaring in the ear. Tinnitus was not always confined to the side of the tumor. In one case (Case 3) it was bilateral. Vertigo was not a major complaint in any of the verified cases. It usually occurred as a slight dizzy attack without nausea or vomiting, and at infre-

quent intervals. In one case (Case 4) the patient had deafness and tinnitus for three-and-a-half years without having vertigo at any time. In the unverified cases, on the other hand, vertigo with nausea and vomiting was the chief complaint of each patient.

Deafness, tinnitus and vertigo are commonly found in affections of the ear itself. The presence of these symptoms, therefore, may



require an investigation not only into the physical and functional integrity of the ears but also into the general and neurological condition before the etiological factors can be accurately determined.

Cochlear Tests: Unilateral deafness was present in all five of the verified cases. The impairment of hearing was moderate in two and marked in three of them. When the audiogram showed a loss of hearing for speech of more than 50 per cent, the "loud voice" test

was used while the opposite ear was being irrigated, in order to make sure that the patient was neither "stone deaf" nor, on the other hand, hearing the tones in the unaffected ear.

The presence of normal hearing on the side opposite to the tumor in these five cases shows only that a tumor of the acoustic nerve does not necessarily cause an impairment of the function of the opposite cochlear nerve. It is doubtful that good unilateral hearing would be found so consistently in a larger number of unilateral acoustic nerve tumors, because the frequency of bilateral deafness due to affections of the ears makes inevitable the occasional coincidence of the two conditions in the same patient. The possibility of bilateral acoustic nerve tumors in patients with symptoms referable to both ears should be kept in mind. A patient examined, not included in this report, had neurofibromatosis with a history of seventeen operations for the removal of these growths. The history and neurological examination suggested that the patient had bilateral acoustic nerve involvement, but the functional ear examination was normal, except for a shortening of bone conduction in both ears. The symptoms were presumably due to the manifestations of cerebrospinal syphilis, a disease later discovered in this patient.

Vestibular Tests: The rotation tests in the verified cases showed an after-rotary nystagmus of about equal duration following rotation to the right or left in three of the five cases; and in only one of the three was there a significant shortening of the time. Two cases showed marked inequality in the duration of the nystagmus that followed rotation to the right and left. One suggested impairment of the vestibular nerve on the side of the tumor and one on the side opposite to the tumor. In only one case, therefore, did rotation tests provide reliable information of the vestibular impairment present.

The after-rotary nystagmus in all cases was of normal type and usually of good amplitude. There were no conjugate deviations or dissociated eye movements. The past-pointing was generally good. The vertigo was brief and in no case was there nausea or vomiting as a result of the testing.

A comparison of the findings on rotation tests in the verified and unverified cases does not show any consistent differences that would be of diagnostic value. Ruttin's² results in the rotation test in tumors of the acoustic nerve support this opinion. He has found normal post-rotary nystagmus toward both sides when tests revealed the patient had no reaction of either the cochlear or vestibular nerve on one side.

The duration of the after-rotary nystagmus following unilateral ear destruction (after labyrinthitis in man and ear ablation in cats and monkeys) has been observed to be definitely shortened on rotation to the side of the intact ear when the examination is made at an early period following the loss of one vestibular end organ^a. At a later time, when the equilibratory mechanism is fully compensated, the difference in after-rotary nystagmus time is usually present, but to a lesser degree.

In the caloric testing the eyes were observed for nystagmus in the primary position and in lateral fixation, in the face front and face up positions. In four cases the caloric tests demonstrated the absence of irritability of the vestibular nerve on the side of the tumor, and in one case the reaction was hard to interpret. In this one doubtful case (Case 2) there was a spontaneous nystagmus which was fast and of large amplitude to the side opposite to the lesion. A small increase in such a phenomenon is difficult to be sure of because a similar type of nystagmus is the normal response to the test.

In four of the five cases on the side opposite to the tumor, the caloric tests showed an impaired function of the vestibular nerve, without a total loss. The diminished irritability was present mainly in the face front position. When findings are as in one case (Case 2), i. e., a gross loss of function of the cochlear and vestibular divisions on one side and a normally functioning acoustic nerve on the opposite side, it is evident that an end organ lesion must be definitely ruled out before venturing a diagnosis of an intracranial condition.

All of the unverified cases showed a nystagmus reaction to caloric tests in each ear; although this was markedly impaired in one case on the side of the suspected tumor.

The past-pointing was generally present when the vestibular nerve showed sufficient irritability to produce vertigo of any considerable degree. The vertigo, however, was usually brief. None of the verified cases had nausea and vomiting as a result of the vestibular testing. Many observers have noted that marked vertigo with nausea and vomiting as a result of vestibular testing is an uncommon occurrence in expanding lesions of the posterior fossa.

The findings reported here are not in agreement with those stated by Jones⁴, Lewis⁵ and others as the usual results of functional ear examination in the presence of such a tumor. This cerebellopontile angle lesion syndrome is described as a total loss of function of both divisions of the eighth nerve on the homolateral side, and a total loss of responses of the vertical semicircular canals on the contralateral side. Fisher^a found a totally nonresponsive ear mechanism on

PREOPERATIVE DIAGNOSIS OF TUMOR OF THE ACOUSTIC NERVE.

ROTATION
Right -Duration 21 sec.
-Duration 16 sec.
Right -Duration 15 sec.
-Duration 25 sec.
-Duration 7 sec.
-Duration 27 sec.
Right Duration 45 sec. Left Duration 31 sec.
Right -Duration 10 sec. LeftDuration 12 sec.
Right -Duration 15 sec. Left -Duration 12 sec.

the side of the tumor, and a loss or impairment of function of the opposite vertical semicircular canals.

In the five consecutive cases examined that are reported here, some hearing was retained in each of them on the side of the tumor and reactions from the vertical semicircular canals of the opposite side were present in all cases.

SUMMARY.

1. In tumors of the acoustic nerve the duration of the ear manifestations before the diagnosis is made justifies making functional ear tests at an early date in patients having a suggestive history. When positive findings are present a complete neurological examination should be made.

2. The results of the rotation tests are not reliable in indicating the vestibular impairment in tumors of the acoustic nerve. The caloric tests, on the other hand, gave dependable information as to the vestibular nerve involvement.

3. The group of findings most consistently present in the verified cases was: An impaired cochlear function and a total loss of vestibular reactions to temperature on the side of the tumor, with a small impairment of the vestibular reactions in the face front position on the side opposite to the tumor.

4. Unilateral deafness was present in all of the verified cases. The impairment of hearing was moderate in two, and marked in three of them.

5. There was a greater loss of the vestibular function than of the cochlear function on the side of the tumor.

REFERENCES

1. Cushing, Harvey: Tumors of the Nervus Acusticus. 1917. 152 p. Philadelphia: W. B. Saunders Co.
2. Ruttin: Quoted by C. O. Nylen: A Clinical Study of Positional nystagmus in Cases of Brain Tumour. Acta Oto-laryngologica, 1931, Supplementary tum XV

3. NORTHINGTON, PAGE, and PIKE, F. H.: Vestibular Tests on Animals with Experimental Lesions of the Nervous System. The Laryngoscope, Feb., 1932
 Jones, I. H.: Equilibrium and Vertigo. 1918, 60 p. Philadelphia: J. B.

Lippincott Co.
5. JACKSON, COATES: The Nose, Throat and Ear and Their Diseases, 1929.
706 p. Philadelphia: W. B. Saunders Co.
6. FISHER, LEWIS: Evaluations of the Caloric and Rotation Tests. Ann.
Otol., Rhinol. and Laryngol., 1931, XL, No. 4.

20 East 53rd Street.

SCLEROTIC MASTOIDITIS AND INTRACRANIAL COMPLICATIONS.*

DR. DAVID N. HUSIK, Philadelphia.

Before considering briefly some salient facts concerning sclerotic mastoiditis, it seems incumbent upon us to take a fleeting glance at the anatomy of the mastoid, insofar as it relates to the subject under review.

The mastoid process is a conoidal protuberance at the lower posterior part of the temporal bone. Upon its outer surface is found the insertion of the sternomastoid muscle. Being, in a large measure, a response to the needs of this muscle, it is natural that it should exhibit a shape and structure conforming in general with the muscular and osseous development of the individual; being large and rough in the robust male, and thinner walled in the female, and in the males of a less developed physique.

Externally, the mastoid consists of a cortical lamina of compact bone; its interior is hollowed out by cavities, diploic or medullary in early life, largely to be displaced later by pneumatic extensions of the tympanum.

Like other cells of the cranium, the mastoid cells are not fully developed until after puberty. These cavities are devoid of known function, but they admirably fit into Nature's scheme of economy, whereby the mastoid process is sufficiently developed to afford insertion to the large sternomastoid muscle.

From a practical viewpoint, this cellular architecture is well adapted to hold away from the cortex the inner table and the structures in relation to it. The inner posterior wall of the process is impressed with the sigmoid fossa which lodges part of the lateral sinus, and which receives a vein from the mastoid foramen.

It is also necessary to remember that the posterior wall of the tympanum presents the openings of the mastoid cells. These lead into canals which communicate with large, irregular cavities contained in the interior of the mastoid process. Thus, the ease with which an inflammation of the middle ear may extend into the mastoid cells, eventuating in thrombosis of the lateral sinus, or even in a cerebral abscess.

^{*}Presented as a Candidate's Thesis to the American Laryngological, Rhinological and Otological Society.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 10, 1932.

With these prefatory words in mind, one is not unprepared to discover possible serious involvement of the mastoid in instances of chronic suppuration of the middle ear, protracted over a period of years. And as a result of prolonged infection of the mucous membrane, a secondary reaction takes place resulting in sclerosis of the mastoid process.

This sclerosis (more properly osteosclerosis) or "eburnation" is the term applied to the reaction occurring most usually at the periphery of the mastoid, whereby the cortex takes on an unusual thickness and continuing over many years, the entire mastoid is converted into solid bone, resembling ivory.

The osseous structure appears unusually dense and hard with obliteration of its landmarks, as is shown microscopically in the absence of blood vessels and Haversian canals in the lamellae of the bone.

Nor is this process of eburnation a beneficent provision of Nature to wall off disease. On the contrary, purulent tracts are often found in the pathologically changed bone and, selecting the path of least resistance, often carry the infective material into the cranial cavity. Another factor favoring cranial invasion is that eburnation is cortical in location and that it advances mesially.

Systematic writers in the field of otology offer many classifications of mastoiditis, at times depending for their nomenclature upon some predominating symptom. Thus, we hear of a septic and of an aseptic type, of a dangerous and a nondangerous form, of a painful and of a painless variety.

To simplify the subject and to establish a study upon a rational basis, we will say a few words about the types of mastoid processes, and then concentrate our thoughts upon the sclerotic variety.

Anatomically, we recognize three types of mastoid processes: t. The pneumatic. 2. The diploic. 3. The sclerotic.

In the *pneumatic* type a number of large cells are present and the cortex is comparatively thin. Early perforation is the rule; this is especially true in children. There are few complications likely to occur, if the direction of the inflammation is external.

The diploic type is most often seen in those who have suffered from recurring attacks of acute otitis media. It is characterized by the presence of multiple small cells and a thickened cortex, a factor which interferes with the localization of symptoms.

In the sclerotic type we encounter hard, ivory-like bone, with distortion of relationships of important structures within the mastoid cavity, such as a marked forward placement of the lateral sinus as

well as the closer approximation of the dura to the field of infection, by obliteration of spaces between the outer and inner table. A profound change having occurred in the structure of the bone, beginning at the periphery of the mastoid process. The cortex assumes an unusual thickness, and with the probable exception of the antrum, which is usually very small, is completely filled with ivory-like bone¹.

From the very nature of the pathological changes induced, it is at once apparent, that localizing symptoms of the affection cannot possibly present themselves through clinical interpretation alone.

All too often, the symptomatology foreshadowing a grave prognosis, in the presence of intracranial involvement, becomes an unfortunate reality. The condition is found almost exclusively in the presence of chronic purulent otitis media.

In not a few instances, one may trace such sclerotic changes from the period of infancy with a known history of tympanic inflammation. Such an inflammation interferes with the usual absorption of the diploe, and subsequent pneumatization. The rationale of this phenomenon is to be found as a result of chronic middle ear suppuration, and its extension to the developing cellular system. The nondevelopment or complete obliteration of cellular growth being effected through the supervention of a condensing osteitis.

As a prophylaxis against the advent of chronic middle ear suppurations or when acute mastoiditis remains with resolution in abeyance, many otologists² would prevent the occurrence of chronic purulent otitis, and its train of damaging, if not destructive symptoms, later in life, by assiduously attacking middle ear and mastoid disease in infancy and early life.

Kopetzky² stresses the immaturity of the mastoid process in early life, emphasizes its partial development and the unclosed sutures which allow purulent, infective material to penetrate into the cranial cavity.

These young sufferers are very prone to meningitic symptoms. This is due in part to the vulnerability of the nervous system in childhood, plus the *direct* transmission of toxic agents through the unclosed petrosquamous suture. The theory of direct transmission is questioned by Baginsky³, who asserts his belief in the contamination of the general blood stream and that intracranial complications are brought about by septic substances in the systemic circulation.

It is convenient to divide sclerotic mastoiditis into two divisions:

1. Cases without intracranial complications, not withstanding the presence of discharge over a period of years.

2. Those cases eventuating in intracranial complications, which demand a guarded prognosis as to danger to life.

In this latter classification, the mastoid process usually reveals the absence of cells, bony changes in the middle ear with eburnation and the presence of an unusually small antrum. Because of the dense cortex there are few pressure symptoms, and the cranial aspect does not suffer the same sclerosis, hence the first indication of serious disease may become manifest as a brain abscess, lateral sinus thrombosis or a meningitis.

Valuable clinical information may often be gleaned by a study of the drum head and the middle ear cavity. As a rule the tympanic membrane has disappeared and only portions of malleus and incus remain.

In most instances, a foul discharge fills the middle ear cavity and the external auditory canal, and although the infected parts may be thoroughly cleansed, nevertheless there remains a constant oozing from the attic, lending the impression of involvement of the bone. As a rule most of these have no pain, tenderness, or rise in temperature.

The mucous membrane in the tympanic cavity, especially in Prussac's space, produces inflammatory (excrescences which result in polyp formations. These polyps must be distinguished from a marked bulging of the drum, from abscess formations in the canal, from exostoses, etc.

In a brief outline of an important subject such as this, no attempt can be made to discuss in detail the many signs and symptoms noted by large groups of earnest investigators in this attractive field of endeavor. It would take a lengthy paper to mention and discuss the inconstant symptoms that may manifest themselves in instances of sclerotic mastoiditis. This was not the intention of the writer. His object was to present some salient thoughts pertaining to the subject, after offering some points upon diagnosis and appending a few interesting illustrative cases.

An important adjunct in the study of sclerotic mastoiditis is the Roentgen ray. But at best, it is only an aid and never can supplant clinical findings. Given a case with a history of repeated attacks of acute mastoiditis, with fetid discharge during intervals and occasional headaches, but no pain, tenderness or rise in temperature, and X-ray findings of hard noncellular mastoids, operation should not be delayed.

All chronic otitic affections will produce more or less eburnation within the mastoid. This eburnation appears as a dense shadow without cellular structure. It is designated a productive change and may be found in all parts of the mastoid.

SUMMARY.

1. Sclerotic mastoiditis is usually the result of repeated attacks of acute middle ear suppuration.

2. History of slight fetid discharge over a period of years, with occasional headaches without pain, tenderness or elevation in temperature, but X-ray findings of hard, noncellular mastoid, indicates surgery.

 Sclerotic mastoiditis distorts relationships of important structures within the mastoid cavity.

4. The dura in sclerotic mastoiditis is in closer approximation to the field of infection, by the obliteration of spaces between the outer and inner table.

5. Intracranial complications in sclerotic mastoiditis are more often encountered, because infection selects the path of least resistance, and enters the cranial cavity.

Up to this point, the foregoing thoughts have been more or less didactic and in the abstract, and in order to give them concrete expression, the following illustrative cases are appended:

Case 1: Sclerotic Mastoiditis, Cerebellar Abscess and Facial Palsy:

D. G., male, age 26 years, was referred to my service at the American Stomach Hospital by Dr. Hawthorne on Jan. 15, 1931, with the chief complaint of discharging right ear since childhood and severe headaches for the past week, following an attack of influenza.

Examination of right ear shows a roomy canal with a fetid discharge. A small perforation in Shrapnell's membrane from which a small amount of fetid discharge was obtained, major portion of drumhead, the head, and handle of malleus was present; medical and neurological examinations were negative.

Examination of eyes shows no pathology in fundi.

X-ray of right mastoid shows increased density throughout and no demonstrable cells. There is no definite local area of destruction except possibly in the region of the attic walls.

Temperature on admission, 98.4°; pulse, 88; respiration, 24; red blood cells, 4,100,000; white cells, 11,000; polymorphonuclears, 84 per cent; large lymphocytes, 14 per cent; small lymphocytes, 2 per cent; urine negative.

On account of history of purulent discharge with intermissions of many years' duration, severe headaches and X-ray findings of dense mastoid and no cells, radical mastoidectomy was decided upon. The headaches were so severe that the patient held his head with his hands, and opiates had no effect.

Operation, Jan. 19, 1931, general anesthesia, radical mastoidectomy was performed. The cortex and inner table was as hard as ivory. The lateral sinus was one-fourth inch from posterior wall. The antrum was very small and difficult to locate. No cells were present. The incus, malleus and granulations from the tympanic cavity were removed. The horizontal semicircular canal was observed. The facial ridge was lowered and stapes noted. The dura over the tegmen antri was exposed to the extent of a one-half-inch square and the lateral sinus was exposed for an inch, outside of some granulation tissue on the exposed dura and lateral sinus which were wiped away, nothing else was noted. Practically no pus was encountered. Panse flap method was employed and the patient was returned in good condition.

The day after operation, temperature, 101°; pulse, 72; respiration, 20. Headaches not as severe as before operation.

On the second day after operation patient developed a chill. Temperature, 103°; pulse, 90; respiration, 28. Continually crying, restless, perspiring freely and complaining of severe pain in his head. On the fourth day while dressing the wound, patient became nauseated and vomited. Daily blood cultures were negative. From the second to the seventh day following operation, the patient had a daily chill, high temperature and sweats; was gradually losing ground and complained of dizziness and headaches. The neck was stiff on the seventh day. Tobey-Ayer test showed suspicious right sinus thrombosis and in spite of the negative blood picture and eye finding, it was decided to reopen wound and particularly to investigate the lateral sinus. Pregyl's iodin gr. 10 was given intravenously from the second to seventh day.

Blood picture after radical mastoidectomy:

W.B.C.	77				
W.D.C.	Hemo- globin	Polys.	Lym.	Large Mono.	Large Lym.
11,000	70%	84%	14%	2%	
33,000	70%	88%	10%	2%	
14,600	70%	75%	20%	4%	
13,000	70%	75%	20%	5%	
12,000	70%	76%	22%	2%	
10,800	70%	85%	12%	3%	
10,000	73%	82%	12%	4%	
10,000	75%	74%	20%	6%	
14,000	80%	85%	10%	2%	3%
	13,000 12,000 10,800 10,000 10,000	13,000 70% 12,000 70% 10,800 70% 10,000 73% 10,000 75%	13,000 70% 75% 12,000 70% 76% 10,800 70% 85% 10,000 73% 82% 10,000 75% 74%	13,000 70% 75% 20% 12,000 70% 76% 22% 10,800 70% 85% 12% 10,000 73% 82% 12% 10,000 75% 74% 20%	13,000 70% 75% 20% 5% 12,000 70% 76% 22% 2% 10,800 70% 76% 22% 2% 10,800 73% 85% 12% 3% 10,000 73% 82% 12% 4% 10,000 75% 74% 20% 6%

We did not feel justified to perform any vestibular tests, due to patient's poor condition. His hearing, however, was practically nil Before operation a spinal puncture was made which showed spinal fluid 10 cells, normal pressure, sugar present, globulin not increased.

Operation, Jan. 25, 1931, general anesthesia. Patient was typed and donor obtained ready for a transfusion following operation. Original incision was enlarged and an additional horizontal incision was carried backward to expose the mastoid process more fully, so as to follow the sinus back to the torcular end. The sigmoid sinus was exposed from the knee downward. The sinus wall was thick. The upper and lower ends were packed and the sinus was opened. Free bleeding was obtained from above and below. In working around the anterior margin of the lateral sinus a few drops of pus suddenly appeared, which called for further investigation. The exposed dura of the middle fossae did not appear as being the source. The dura in Trautman's triangle was then separated from the petrous bone and a half drachm of pus under tension was located in that area. When the pus was cleared away a fistulous tract was seen leading toward the cerebellum. No macroscopic lesion was seen in the bone. The dural opening was enlarged and a strip of iodoform gauze was inserted, and the whole wound was packed with iodoform gauze and left wide open. Patient was returned to bed in fairly good condition. Three hours later a blood transfusion of 260 c.c. was given. After operation temperature dropped to 97°; pulse, 120; respiration, 24. Temperature remained between 96° and 97° for several days and then went to 99°, and pulse to 68. He was relieved of his headaches and while he appeared somewhat drowsy, made no complaints.

. Blood picture following cerebellar drainage:

Date	R.B.C.	W.B.C.	Hemo- alobin	Polys.	Lym.	Large Mono
1/26/31	3.260,000	18,000	74%	83%	12%	5%
1/27/31	4,190,000	15,200	70%	77%	18%	5%
1/28/31	4.000,000	14,000	70%	70%	29%	1%
1/29/31	4,000,000	13,800	69%	66%	31%	3%
1/30/31	3,560,000	14,000	64%	77%	20%	3%
1/31/31	3,540,000	16,200	62%	80%	17%	3%
2/ 3/31	3,290,000	16,450	64%	90%	4%	4%
2/ 4/31	3,510,000	15,005	65%	73%	16%	10%
2/ 5/31	3,250,000	18,000	65%	89%	1%	8%
2/ 6/31	3,490,000	13,300	65%	79%	8%	10%
2/ 9/31	3,760,000	9,900	67%	78%	12%	5%
2/20/31	4,000,000	9,000	71%	72%	24%	2%

The temperature became normal several days after the second operation. Pulse, 70; respiration, 24. Was given transfusion every third day of 250 c.c. for five days. The drain from the cerebellar area was removed on the fifth day and repacked. Packing from the

upper and lower ends of the sinus was removed at the same time. The wound was dressed every day and 32 days following the second operation he was discharged from the hospital, weighing 32 pounds less but feeling quite well.

The cerebellar area was kept open for several months after his discharge from the hospital and it was then allowed to close. A month after the cerebellar area was allowed to close and three months after his second operation the patient suddenly developed a complete right-sided facial palsy.

Under local anesthesia, the wound was reopened, granulation tissue in front of the lateral sinus was removed and a few drops of pus were found coming from the original opening of the cerebellar area. A drain was again inserted and the wound was redressed every day. The facial paralysis began to show improvement in about a week, and in six weeks it had entirely cleared up.

The cerebellar area, however, was kept open for several weeks longer. On July 25th, the drain was completely removed and the cavity was allowed to close.

The patient is now well, free of headaches and aural discharge, back to normal weight and attending to his business.

The occurrence of facial paralysis can be explained by pressure of pus near the facial nerve in the region of the internal auditory meatus. At the last examination, ten months after operation, patient is apparently well with the exception of a post-auricular fistulae, which we intend closing up shortly.

Comment: Because of the sclerosis of the mastoid in this case it was impossible for the infection to travel to the external surface, and took the easiest route into the cranium, and I therefore feel that the sclerosis in this case was the conspicuous factor in causing the lesion to become intracranial.

Case 2: Sclerotic Mastoiditis and Temporosphenoidal Lobe Abscess: F. F., male, age 52 years, admitted to my service at the Mount Sinai Hospital, Jan. 30, 1931, having been referred by Dr. Ralph Goldsmith, with the chief complaint of discharging right ear and mastoid tenderness.

The patient complained of pain in the right ear for three or four days before spontaneous rupture occurred, and about five days before admission. No accurate history of a previous otitis media could be obtained from either patient or family.

General physical examination was negative with the exception of asthmatic attacks for 15 years, for which morphin was taken. He is now a morphin addict, taking two grains daily. Temperature on admission, 101°; pulse, 80; respiration, 20. Ear examination shows a purulent exudate in the external auditory canal and a central perforation in the drumhead. Nose and sinuses show acute congestion.

X-ray of right mastoid shows septae still visible and general density over the whole mastoid area with probable tip necrosis.

Blood picture shows: Red blood cells, 4,170,000; white blood cells, 12,000; polynuclears, 80 per cent; hemoglobin, 80 per cent.

Under rest in bed and local medication, temperature became normal, mastoid tenderness disappeared, discharge became scanty, and the patient was discharged on Feb. 6, with instructions to return to the clinic for further treatment.

He reported several times for treatment, his ear became dry and he was free of symptoms as far as his ear was concerned. He was then admitted to a sanatorium for the treatment of his morphin habit.

About two months after his discharge from the hospital, he was again seized with an acute cold and pain in the right ear. He visited a doctor, who informed him he had an abscess in his right ear, and performed a paracentesis. Several days later examination shows the ear draining freely, slight mastoid tenderness, temperature of 100°; pulse, 80. He was admitted to the hospital on the following day.

Temperature on admission, 101°; pulse, 80; respiration, 20. X-ray shows general density of cellular structure, indistinct septae and tip necrosis.

Blood picture: Red blood cells, 4,430,000; white blood cells, 14,000; hemoglobin, 80 per cent; polynuclears, 80 per cent; urinalysis negative.

The patient appeared somewhat drowsy, and we were under the impression that he was under the influence of opiates. Four days after admission, with no abatement of symptoms, a mastoidectomy was performed.

Operation, April 15, 1931, general anesthesia. The cortex and inner table were as hard as ivory, only a few drops of pus at the top of the mastoid and some granulations in the antral region. The dura and lateral sinus were exposed, and appeared normal. Only a few cells were encountered at the tip. The lateral sinus was about ½-inch from posterior wall.

The following day, he became stuporus and developed a paralysis of the left face, arm and leg. Temperature, 103°; respiration, 24; pulse, 60. Red blood cells, 4,430,000; white blood corpuscles, 14,000;

polynuclears, 80 per cent, hemoglobin, 80 per cent. Answers question slowly.

Neurological report, April 16, by Dr. N. Winkelman. Patient comatose and irresponsive. Pupils under the influence of a mydriatic, divergent strabismus present, corneal reflex absent in the left eye, gag reflex present, radial reflexes absent on left, triceps and pectoral reflexes diminished on left, positive Babinsky on left. Does not move the left arm or leg, and when pricked with a pin, are only feebly stirred. He has a rigidity of the neck and bilateral Kernig.

In view of the history and supervention of coma, meningeal signs and septic temperature, a diagnosis of intracranial involvement is fairly certain. Lesion is probably an extradural abscess. Location is mostly likely over the right temporosphenoidal lobe. Advise exploratory craniotomy. Lumbar puncture, turbid fluid, 9,000 cells, 90 per cent polynuclears, and 10 per cent lymphocytes, sugar +, globulin 3+, no growth.

Eye examination: Suspicious beginning papilledema, haziness of left disc, but not definite enough for diagnosis.

The patient was again taken to the operating room, 48 hours after first operation, the original mastoid incision was enlarged upward, and posteriorly, cortex of the tegmen antri was removed, exposing a square inch of dura. The dura appeared under tension and when incised the brain seemed to bulge. Three exploratory punctures into the temporosphenoidal lobe were made for about an inch in depth, and the last and most forward one yielded about 3 ounces of pus.

The cavity was washed out with hot saline solution, iodoform drainage inserted and whole wound packed and left open. Rubber drainage tube recommended by brain surgeons.

The following day, eye examination showed papilledema right side, condition of patient poor, pulse rapid, and feeble; respiration shallow; and unconscious. Death occurred on April 20, four days following evacuation of abscess.

Postmortem Findings: "An incision was made into the dura over the right temporal region, and a large amount of pus was evacuated. On lifting the dura back from the brain substance, almost the entire right temporal lobe was replaced by an abscess containing thick pus. There is a marked pallor over the entire section in the right hemisphere of gray and white matter as well, particularly in the posterior portion, which corresponds to the above mentioned abscess. The tissue of the right hemisphere is decidedly softer than that of the left hemisphere." Comment: The question suggests itself whether this case might have turned out more favorably had a mastoidectomy been performed at the time of first admission. This could have been indicated because of the X-ray findings of scleroses in spite of the fact that clinically the signs of mastoiditis had subsided.

Case 3: Sclerotic Mastoiditis and Temporosphenoidal Lobe Abscess: M. K., female, age 18 years, was admitted to the Mount Sinai Hospital on the medical service, Aug. 9, 1931, with the chief complaint of nausea, vomiting, right-sided headache, and pain in her right ear. The patient stated that she had been treated for purulent otitis at intervals for the past year. Acute otitis media in her right ear began at the age of 5 years, and discharge has practically never cleared up. Family and social history negative.

Examination on admission disclosed a toxic, extremely lethargic young female, complaining of right-sided headache. Temperature, 100°; pulse, 88; respiration, 28; blood pressure, 110/60. There was a scanty foul, purulent discharge from the right ear, and a small perforation in Shrapnell's space. There was no clinical evidence of acute mastoiditis or meningitis. Urinalysis showed 3 per cent sugar, acetone, and a faint trace of albumin. A leukocytosis of 25,250 with 98 per cent polymorphonucleosis was present. Lumbar puncture showed an increase in pressure (20 m.m. mercury) and contained 4,000 white cells (chiefly polys). No organisms were seen on smear or developed on culture from this spinal fluid. The attending medical staff were of the opinion that the patient had a mastoiditis with an intracranial complication (probably brain abscess). The neurological surgeon saw her in consultation the same day and recommended no brain surgery, but rather a mastoidectomy. The eye grounds and visual fields were normal. X-ray showed sclerosis of right mastoid. On Aug. 10, a modified radical mastoidectomy was performed. The whole mastoid area was densely sclerosed; no cells present, only some granulations in the antral region. The dura and lateral sinus were exposed and nothing abnormal noted. No pus was found in any part of the mastoid. The patient was somewhat improved for the next few days, headaches somewhat relieved. She was again examined by the neurologist and neurosurgeon, both of whom were of the opinion that she should be left alone. The medical staff felt that a brain abscess was present. Four days after operation, patient seemed quite well; temperature, 100°; pulse, 64; respiration, 20; mentally clear, headaches relieved and neck less rigid. Lumbar puncture showed spinal fluid pressure to be 8 m.m. mercury and to contain only 239 white cells. The patient seemed to keep on improving, with the exception of a pulse rate of 64. Eight days after operation, the patient began to complain of severe headaches, pulse rate between 48-53 per minute; lumbar puncture revealed increased pressure, 20 m.m. mercury (in recumbent posture) and 153 white cells. Eye examination revealed low-grade papillitis of the right eye. Visual field study showed the presence of a homonymous upper quadrantanopsia (more marked in the right field).

The next morning the patient became drowsy, pulse rate of 48, and there were definite signs of left-sided lower facial palsy. Because of this and severe headaches, a trephine opening was made one-half-inch above the tip of right ear, under local anesthesia. The dura did not pulsate, and the brain herniated on opening the dura. Exploration with cannula revealed an abscess about one-half m.m. below the cortex containing 30 c.c. of thick yellow pus, having a colon bacillus odor. The pus was evacuated, and a drainage tube placed into the cavity, which was washed with 1 per cent mercurochrome. The wound was not sutured, but the tube was held in place by gauze packing.

The patient began to improve several hours after operation; the tube in the brain abscess cavity was shortened the following day and cavity irrigated with 1 per cent mercurochrome. The visual field was definitely less in degree than before operation. Temperature remained normal, pulse up to 72 and wound was dressed daily.

On Sept. 4, the patient appeared well, mastoid wound had entirely healed, the trephine area is clean, healing without drainage, and the patient is up in a chair. Patient was discharged from the hospital, Sept. 11, in excellent condition, 33 days after admission, with a dry skull wound and dry ear.

Comment:. This is another case of sclerosed mastoid with no macroscopic pathology in the mastoid at time of operation, except sclerosis and history of discharging ear since childhood. The infection in this case traveled intracranially because of the greater resistance of the sclerosed bone.

1930 Chestnut Street.

REPORT OF FIVE CASES OF LATERAL SINUS THROMBOSIS WITH SEPTICEMIA— RECOVERY.*

DR. EMIL R. MAYERBERG, Wilmington, Del.

This paper is presented not because the subject is a rarity or because the treatment and recovery present any remarkable features; each of the cases, however, do present some degree of obscurity and difficulty in diagnosis, and the treatment varied greatly in nearly all of them.

Case 1: B. O., school girl, age 9 years. Chief complaint was pain in the right ear. Family history was negative. Past history was negative.

History of Illness: The child complained of pain in the right ear on Feb. 2, 1929, two days before admission to the hospital. On the second day the ear began to discharge a slight, bloody, watery fluid, but the pain continued almost as severe as before and was present on her admission to the hospital on Feb. 5. She had not had any illness prior to the earache and did not appear to have a head cold.

On admission, Feb. 5, 1929, her temperature was 101.3°; pulse, 96; respiration, 24. Her lungs were clear on percussion, palpation and ausculation. Heart normal. The reflexes were equal on both sides, active but not exaggerated. Eyes, nose and throat were negative.

Right Ear: The drum was extremely congested and bulging, landmarks were obliterated, bogginess of the superior and posterior canal wall. There was slight tenderness on deep pressure over the body and tip of the right mastoid.

Blood Count: Hg., 80; reds, 3,950,000; whites, 11,500; Pm., 72; Lm., 4; Sm., 24; Eos., 0; Trans., 2.

Urinalysis: Yellow, acid, specific gravity, 10.19; faint trace of albumin, no sugar, few W. B. C., few epithelial cells.

Treatment: Myringotomy performed under nitrous oxid oxygen anesthesia, followed by the instillation of a warm solution containing camphor-menthol, alcohol and glycerin, every four hours. Laxative given and liquid diet ordered. The temperature was irregular, ranging from 101.3° to 103.2°; pulse, from 96 to 136; respiration, from

^{*}Read before the Philadelphia Laryngological Society, Feb. 2, 1932. Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 10, 1932.

24 to 40. The X-ray report the following morning showed cloudiness of the right mastoid cells, but no cell destruction.

Feb. 6: Patient had had fairly comfortable night. The pain had stopped and she was taking nourishment well; but the temperature continued and was irregular. Blood count unchanged.

Feb. 7: The patient complained of pain in mastoid region and had a headache. She did not sleep well. Temperature at 2 a. m. was 105°; pulse, 136; respiration, 40. C. B. C.: Hb., 75,390,000; whites, 18,500,000; polys., 70. The right mastoid was opened, cells were congested, but very little cell destruction, free pus was found on approaching the antrum. The lateral sinus wall was removed and the sinus appeared normal. The plate was solid throughout. The wound was left open and drained with iodoform gauze. The culture taken from the mastoid, reported following day, showed bacillus pyocyaneus and streptococcus. Blood culture negative.

Feb. 8: The patient complained of headache and pain in the operated area. Temperature, 105°; pulse, 136; respiration, 40. Pain in the left leg. Eye grounds were negative. Complained of pain in the neck, with some stiffness. Lumbar puncture was done; found 92 drops a minute, clear fluid, showed two cells; globulin negative; blood culture negative.

Feb. 9: Temperature, pulse and respiration still elevated and irregular; had a slight chill, redressed, and wound found in good condition. The blood picture was unchanged; culture negative.

Feb. 10: Temperature irregular; slight chill, and patient very drowsy. She did not complain of headache, but complained of pain in the left knee.

Feb. 11: Condition unchanged, except for pain in left knee, which was beginning to show swelling and redness and tenderness. Temperature dropped to 100° at 11 a. m. and remained so until 6 p. m., then to 103.1°, and at 11 p. m. was 104.2°, and continued above 101° until 5 p. m., Feb. 12, then going to 105.2°. She had two chills during the twelfth and complained more of the left knee, which had become more swollen. She had nausea and vomiting. Blood count: Hb., 75; reds, 3,810,000; whites, 14,150; Pm., 74. Blood culture was negative.

Feb. 13: Condition unchanged. Codein for pain in the knee.

Feb. 14: Blood culture returned positive, streptococcus and bacillus pyocyaneus. C. B. C.: Hb., 60; reds, 3,350,000; whites, 22,400; polys., 87 per cent. Left knee was aspirated by Dr. Edwin Bird. X-ray showed fluid in the joint; 26 c.c. of greenish fluid obtained. Culture showed streptococcus and bacillus pyocyaneus. It was felt

advisable on account of the knee involvement and the positive blood culture to open the lateral sinus and ligate the internal jugular. My friend, Dr. George M. Coates, concurred in this opinion and we operated that same day. The sinus bled freely when opened, but there was a decided roughening of the intima and thickening of the sinus wall. The jugular was ligated above the facial. Transfusion given, using 250 c.c. citrated blood.

Feb. 15: Temperature running more evenly, ranging from 102° to 103°. Pulse, 108 to 132; respiration, 24 to 30. Complained of

pain in cardiac region and in left knee.

Feb. 16: Patient feeling better generally, no headache, no nausea or vomiting, took fluids well. No chills. Knee still painful and swollen. Urinalysis showed many pus cells and trace of albumin, for which urotropin was prescribed. Fluids forced. The knee was aspirated, 20 c.c. of fluid removed.

Feb. 17: Temperature running evenly at 101°; pulse, 120; respiration, 24. Redressed, but plugs not disturbed. Knee aspirated, 10 c.c. of fluid removed. Child felt better, took more nourishment. Blood culture negative after third day. C. B. C.: Hb., 62; reds, 3,300,000; polys., 82 per cent.

Feb. 18: Temperature down to 99° at 6 a. m., 100.3° at 12 noon, 102° at 10 p. m. Knee very painful during the day and morphin

given. Redressed and the lower plug removed.

Feb. 19: Temperature ranging from 100.2° to 102.2°. Knee still painful, aspirated; 15 c.c. of fluid removed. Second plug removed, no bleeding, wound in good condition, packed open; 150 c.c. citrated blood given intravenously. Blood culture negative.

Feb. 20: Temperature not above 100°. Knee still painful, aspirated; 8 c.c. of fluid removed. Sterile. Dressed. One hundred c.c.

citrated blood intravenously.

Feb. 21: Temperature, 99° to 100°. Knee aspirated, no fluid obtained. Knee baked. Fifty c.c. citrated blood intravenously. Blood culture negative. C. B. C.: Hb., 64; reds, 3,300,000; whites, 8,550; polys., 72 per cent.

Feb. 22: Patient was taken off all medication, put on modified diet. She was given light treatment over whole body. Knee not

aspirated, not so painful and not much swelling.

Feb. 23: Blood culture negative. Light treatment given daily and full diet given.

Patient discharged from the hospital on Feb. 28, with temperature ranging from 98.2° to 99.3°, and still needing dressing, but she was turned over to her uncle, who is a physician in her home town, and

he reported favorably until she had completely recovered. She had to be dressed for a month after she went home and the knee required treatment for a long time before its function was re-established.

Summary: This case is interesting because of the type of infection. I do not recall having seen an acute case of mastoid having a bacillus pyocyaneus as one of the causative factors. I have seen this organism in chronic cases, but I have not encountered it in blood stream infections. It is also interesting from the standpoint that she was not given any type of serum, but the treatment depended entirely upon the transfusions. She received during her illness 600 c.c. of citrated blood.

Case 2: H. E. H., age 5½ years, female. Family history was negative. Past personal history was negative except for pyelitis.

History of Present Illness: The child had scarlet fever and during the convalescent period the left ear began to ache and the temperature, which had been normal for several days, went up. Dr. Charles Wagner, the pediatrician in charge of her case, ordered an ear drop to be used for 24 hours and when the pain had not subsided, and he found the drum red and bulging, did a paracentesis. The ear discharged very freely and the temperature dropped to normal and remained so for three days. It then went up and the child complained of pain back of the ear. The writer saw the child for the first time on May 26, 1931. At that time the ear was discharging copiously, thick purulent material. The postauricular crease was absent. The ear stood forward and there was a distinct sagging of the superior posterior wall. The opening in the drum was of good size. The drum was edematous and all landmarks obliterated. A diagnosis of acute mastoiditis was made and immediate operation advised. The parents agreed the following day, and the patient was admitted to the hospital on May 27, 1931. On admission, at 10 a. m., the temperature was 99°; pulse, 100; respiration, 22. C. B. C.: Hb., 78; reds, 4,990,000; whites, 15,000; Pm., 68; Lm., 2; Sm., 28; Eos., 0; Baso., 0; Trans., 2; coagulation time, 4½ minutes. Urinalysis: Amber, acid; specific gravity, 10.19; faint trace of albumin. Many white blood cells. X-ray, left side, showed no evidence of any posterior cells, anterior portion of mastoid fairly clear; right side normal. Temperature at 1:30 p. m., 102°; pulse, 120; respiration, 24. Operation at 2:30 p. m., simple mastoidectomy. Pus encountered on removing cortex, cells necrotic and filled with granulation tissue. The sinus wall appeared normal and was not removed. Wound drained with iodoform gauze and left open. Culture from mastoid wound showed hemolytic streptococci. The postoperative condition was good, although the patient seemed restless and cried a good bit. Morphin, gr. 1/20, given hypodermically at 10:30 p. m. Had comfortable night.

May 28: No particular complaints. Temperature ranging between 99° in a. m. and 101.2° in p. m. Urinalysis unchanged. Took fluids well and eliminated well. Ordered soft diet. Dressing saturated and

outer part changed.

May 29: Patient slept well during the night, hungry for breakfast, insisted upon more food, paid more attention to her toys. Maximum temperature, 100°; minimum temperature, 98.4°. Maximum pulse rate, 110; minimum pulse rate, 96; respiration: maximum, 24; minimum, 22. Output normal. Wound dressed and part of packing removed.

May 30: Patient in cheerful and playful mood. No complaints. General diet ordered. Maximum temperature, 100.2°; minimum, 98.4°. Insisted upon having more food, showing a decided preference for sweets, but with much persuasion took portions of all food offered. Dressed. Portion of packing removed. During the night the patient became restless and fretful, but slept toward morning and seemed improved in the morning. C. B. C.: Hb., 76; reds, 4,200,000; whites, 10,500; polys., 69 per cent. Condition unchanged during the next three days. Temperature: maximum, 100°; minimum, 98°. The patient slept and ate well and was in good spirits.

June 4: The patient seemed cross when aroused and refused her food. Temperature: maximum, 103°; minimum, 98°. Wanted to sleep a lot. C. B. C.: Hb., 72; reds, 3,750,000; whites, 20,500; polys., 86; Lm., 2; Sm., 28. Urinalysis unchanged except for increase in pus cells. Dressed. All packing removed. Wound cleansed, small strip of plain packing for drainage. Output good. Blood culture ordered because of the rapid drop in the red cells and Hb. report negative.

June 5 and 6: Temperature and pulse still irregular.

June 6: Decided to uncover the sinus and look for more necrotic bone. Dr. George M. Coates was called in consultation and he and the writer operated that afternoon. Considerable necrosis was found, extending upward and backward. The sinus wall was solid except for pinhead area. Sinus found thrombosed and softened in the center. Osteomyelitis around the mastoid wound with necrosis of dural plate. Internal jugular vein ligated above the facial. Culture from sinus showed hemolytic streptococcus. Temperature: maximum, 103.2°; minimum, 100.2°. Pulse: maximum, 136; minimum, 128. Respiration: maximum, 28; minimum, 24.

June 7: Patient not so restless, but did not want food, had to force her to take fluids. She developed twitching of left side of face and eyelids. Temperature: maximum, 104°; minimum, 102.3°. Urinalysis showed many pus cells. She was given 300 c.c. whole blood by direct transfusion. Blood culture negative.

June 8: Patient much more comfortable. Began to take more interest in her toys, wanted food. Temperature: maximum, 102.1°; minimum, 98.3°. Dressed; portion of packing removed. C. B. C.: Hb., 61; reds, 3,400,000; whites, 69.

June 9 and 10: General condition seemed better, child brighter. Temperature ranging from 102.1° to 98°. Dressed daily.

June 11: C. B. C.: Hb., 62; reds, 3,750,000; whites, 20,500; polys., 82. Blood culture negative. Two hundred c.c. blood given by direct method.

June 12: Patient very restless during the night. Cried out in her sleep. Complained of headache and pain in left eye. Eyelids slightly edematous. Temperature: maximum, 103.1°; minimum, 100°. Spinal puncture, fluid clear, not under pressure, negative for globulin, two cells. Amytol, gr. 34, PRN. for pain.

June 13: Patient cross at times, slept better during the night. Plugs removed. No bleeding. Temperature: maximum, 102°; minimum, 99°. Some headache.

June 14: Complained frequently of headache during morning, but toward afternoon patient seemed brighter than usual. Took nourishment freely and had a large evening meal. While the writer was making his night visit to the patient about 9:30, he pulled the covers down and found the dressing saturated with blood, the gown and bedding and pillow soaked. The child was sleeping. His first thought was that she was bleeding from one of the ends of the sinus. It turned out to be a skin vessel in the neck wound that had been bleeding. It was caught with a hemostat and ligated, dressing applied. Temperature: maximum, 101.2°; minimum, 99.4°. Pulse: maximum, 132; minimum, 104.

June 15: Seemed very quiet during the morning. Would not move the head, did not complain, took nourishment well, but toward afternoon began to complain of headache. C. B. C.: Hb., 67; reds, 3,850,000; whites, 13,500; polys., 60. Blood culture negative. Urinalysis unchanged. Still showing trace of albumin and many pus cells. Parents and family physician objected to more transfusions. Temperature: maximum, 103.2°; minimum, 99.2°. Pulse: maximum, 120; minimum, 96.

June 16: Headache; drowsiness. Temperature at 8 a. m. was 99.2°; pulse, 104. 11 a. m.: temperature, 98.3°; pulse, 92. 1:30: temperature, 100.2°; pulse, 96. 3:30: temperature, 103.3°; pulse, 124. 4:30: temperature, 105.2°; pulse, 144. Tepid sponge given. 5:30: temperature, 104°; pulse, 144. 6:30: temperature, 104e; pulse, 160. Fifteen c.c. of glucose given intravenously. Eye grounds showed no change. Reflexes normal. Complained of pain in both legs. Dr. Temple Fay called in consultation. His findings as a whole were negative. He thought, in view of the lateral sinus thrombosis and ligation of the jugular, cerebral hyperemia and edema might be expected. However, the temperature and pulse rise was not associated with change in respiration, and edema of the base of the brain, therefore, was not indicated. His diagnosis: First, infectious hyperthermia. Second, low-grade cerebral edema. He advised glucose intravenously, magnesium sulphate enema when necessary, phenacetin in small doses, repeated sponges, no bandage around the neck. Continued conservative observation.

June 17 and 18: Temperature: maximum, 104.3°; minimum, 99.1°; pulse: maximum, 136; minimum, 100; respiration: maximum, 28; minimum, 24. Child did not complain, took food, and seemed bright. Dr. Coates stopped in to see her while passing through the city on the seventeenth and said if she wasn't better in two or three days to go into the wound again.

June 19: Temperature: maximum, 105.2°; minimum, 99.1°; pulse: maximum, 144; minimum, 100; respiration: maximum, 28; minimum, 24. C. B. C.: Hb., 66; reds, 3,610,000; whites, 12,100; polys., 79 per cent. Urinalysis: Trace of albumin, many pus cells. Blood culture negative. Left eye swollen.

June 20: Condition unchanged. Operation decided upon, and Dr. Coates, Dr. Ersner and the writer operated that afternoon. Osteomyelitis found extending backward and upward. Considerable bone was removed. Sinus followed backward toward torcular and a clot found. It was several millimeters long and was breaking down. It was removed and free bleeding obtained. Plug placed and wound packed. Immediate postoperative condition good.

June 21: Culture from the clot positive for hemolytic streptococci. Blood culture taken immediately after operation was reported as positive for hemolytic streptococci, showing seven colonies total on three plates. Temperature: maximum, 104°; minimum, 98.3°; pulse: maximum, 160; minimum, 100; respiration: maximum, 40; minimum, 20. Patient restless, refusing food, twitching of face muscles, eye still swollen. One hundred c.c. antistreptococcic serum given in-

travenously, followed by vomiting of large amount of clear fluid. Repeated sponges given, Quinin bisulphate ordered.

June 22: Had slight reaction from the serum during the night, no muscular twitching, slept fairly well. Temperature: maximum, 102.1°; minimum, 99°; pulse: maximum, 120; minimum, 88; respiration: maximum, 28; minimum, 24. Blood transfusion was given, using 50 c.c. of citrated blood. Dressed. Part of packing removed. Blood taken for culture.

June 23: Condition improved. Patient bright and cheerful. Temperature: maximum, 100.4°; minimum, 97.4°; pulse: maximum, 104; minimum, 88; respiration: maximum, 24; minimum, 20. Blood culture taken the day before reported positive, five colonies. Fifty c.c. citrated blood given intravenously.

June 24: Temperature: maximum, 99.4°; minimum, 97.4°. Condition improved. Blood taken for culture. Dressed. Part of packing removed.

June 25: Culture reported positive, 35 colonies. Temperature: maximum, 103°; minimum, 99.3°; pulse: maximum, 128; minimum, 100; respiration: maximum, 28; minimum, 24. Patient drowsy. Eye not so swollen. No twitching of face. One hundred c.c. citrated blood given. Blood taken for culture.

June 26: No change from day before. Plug removed and some little pus found around and behind it. No bleeding. Sixty c.c. citrated blood given. Blood culture reported negative.

June 27: Condition much improved. Maximum temperature, 98.2°; minimum, 97.2°. Sixty c.c. citrated blood given. From then on the blood culture was negative, but she was given 50 c.c. of citrated blood daily for the next five days.

July 1: The patient's temperature went to 100° and she developed urticaria, which was very annoying for three days. Temperature reached as high as 102.1° during this period, but came back to normal on July 3, and did not go up again. She was discharged from the hospital on July 7.

The patient improved steadily from that time, was dressed daily and she spent August and most of September at the seashore. She gained considerable weight and was in condition to enter school late in September. The wound continued to crust for several months after the dressings had been removed, but when the writer saw her in January of this year that had stopped and the wound had completely healed over.

Summary: This case is interesting from the standpoint of the obscurity and complexity of the symptoms and the treatment. She

received 100 c.c. of serum and had twelve transfusions, getting a total of 1100 c.c. of blood, first the whole blood and then the citrated blood.

Case 3: H. B., school boy, age 9 years. Family history was negative.

History of Illness: Several days before patient was admitted to the hospital he was sledding and came into the house wet to the skin. That night he began sneezing and his nose was stuffy. The next morning he had a chest cold and was kept home in bed. He ran a temperature for three or four days and then felt better. The next day he went to school. While there he had occasion to blow his nose and while blowing he felt a cracking in the right ear, followed soon after by pain in the ear. It became so intense that it was necessary to go home. His family physician ordered drops to be used and he felt more comfortable for a while. During the night the pain again came on and the next morning the writer was asked to see him. The right drum was red and bulging and a myringotomy was done in his home under ethyl chlorid anesthesia. The drops were continued. His temperature at the time was 101.2°; pulse, 96; respiration, 20.

The writer did not hear from the case (whose home was in a town fifty miles away) for five days. Then the family physician reported a return of temperature, which had been normal for three days, intense pain in the ear, and tenderness and a little swelling back of the ear. The patient was sent to the hospital that day, Feb. 2, 1930. Temperature on admission, 102.3° ; pulse, 116; respiration, 28. Urinalysis negative. C. B. C.: Hb., 81; reds, 4,220,000; whites, 18,500; Lm., 2; Sm., 17. X-ray showed cloudiness of the right mastoid and no destruction of cells. Temperature by evening had gone to 104.2° .

Feb. 3: A simple mastoidectomy was done on the right side, no free pus was encountered until the antrum was approached, all the cells engorged. The sinus wall appeared solid and healthy and was not removed. The wound was packed and left open. Culture was taken from the mastoid. Temperature dropped to 101.4° by evening. No complaints.

Feb. 4, 5 and 6: Were fairly good days. Report from culture taken from the mastoid showed hemolytic streptococci. Patient took nourishment, eliminated well and did not complain.

Feb. 7: Patient felt chilly, was unusually quiet. Temperature went to 104° by evening. C. B. C.: Hb., 70; reds, 3,300,000; whites, 13,500. Blood taken for culture.

Feb. 8 and 9: Blood culture negative. Temperature: maximum, 104.1° ; minimum, 99.1° ; pulse: maximum, 120; minimum, 84; respiration: maximum, 28; minimum, 22. No improvement in general symptoms.

Feb. 10: Blood culture reported positive for hemolytic streptococci. Urine showed albumin and pus cells. Patient given 50 c.c. of antistreptococcic serum. Sinus opened and while it bled it was not free and the lumen was almost occluded. Right internal jugular vein ligated. Patient had severe chill a few hours after operation.

Feb. 11: Temperature: maximum, 105°; minimum, 99°; pulse: maximum, 140; minimum, 100; respiration: maximum, 32; minimum, 24. Patient appeared ill, vomited frequently and did not want to be disturbed. He did not complain, but appeared very toxic. Blood cultiure positive. C. B. C.: Hb., 62; reds, 3,200,000; whites, 12,500; polys., 75. Dr. Joseph Wales, pediatrician on service, was called into consultation, and found that he had endocarditis, had a mitral systolic murmur, and irregular pulse. Patient complained of pain in both legs and back. Both ankles and knees swollen in sacral region. Child given Pregle's iodin 10 c.c., 50 c.c. serum, and 100 c.c. whole blood intravenously.

Feb. 12: No change. Temperature still ranging from 99° to 105°, with chills daily. Heart action not good. Child received 10 c.c. Pregle's iodin, and 25 c.c. serum and 50 c.c. blood daily for the next six days. At the end of that time temperature was down to 101.2° to 97° and blood culture was negative. The right ankle and left knee and the sacral region had been opened and pus found. Plugs removed from the sinus on sixth day.

Feb. 18: C. B. C.: Hb., 82; reds, 4,280,000; whites, 23,000: polys., 73. Temperature: maximum, 101.2°; minimum, 97°. Blood culture negative.

Feb. 19: Blood culture positive. More serum and blood given.

Feb. 20 and 21: No change. Blood culture negative.

Feb. 22: Blood culture positive; 10 c.c. Pregle's iodin, 25 c.c. serum and 50 c.c. blood given.

Feb. 23: C. B. C.: Hb., 82; reds, 4,280,000; whites, 23,000; polys., 75. The left knee was opened and pus obtained. Heart action not good. Wound in good condition and draining freely. Temperature: maximum, 103.1°; minimum, 99.1°.

Feb. 25: Blood culture negative. C. B. C.: Hb.. 82: reds, 4,280,-000; whites, 13,500. General condition improved. Took nourishment. No complaints except for pains in joints and back. Ran irregular temperature from 102° to 98° for several days. Blood culture

negative from Feb. 23 to March 28, when he was discharged from the hospital. Heart had quieted considerably and he ran a slight temperature on discharge. Mastoid completely healed and joints and back wound healed. Received Alpine light treatment daily during last four weeks of treatment, and the pediatrician looked after general treatment and medication during that time.

Summary: He had, all told, 350 c.c. serum, 50 c.c. Pregle's iodin, 850 c.c. of whole blood.

Case 4: J. W. J., male, age 36 years. Family history was negative. Personal History: About two months before admission to the hospital the patient had pneumonia. He developed an earache in the right ear and had a paracentesis done. The ear drained for a long time after he had recovered from the attack of pneumonia. He thought it had finally stopped draining, until two weeks before the writer saw him when the ear began to pain again, and in a few hours the ear drained and he felt better, so much so that he went to work the next day. Had no more severe pain, until two days before admission to the hospital he noticed twinges in the ear and tenderness back of the ear. The attending physician saw him that evening and sent him in to the hospital on the writer's service the next morning, having made a diagnosis of acute purulent mastoiditis.

On admission, Jan. 25, 1928: Temperature, 99.2°; pulse, 84; respiration, 20. C. B. C.: Hb., 85; reds, 4,420,000; polys., 90 per cent. X-ray showed destruction of most of mastoid cells. Operation. Simple mastoidectomy. Subperiosteal abscess found and fistula in cortex with much necrosis. Cells exenterated, table of sinus removed and found necrotic, dural plate necrotic, sinus covered with granulation tissue and pus under plate. The sinus, however, was soft enough and filled quickly after pressure. It was not opened. Wound packed and left open. Culture from mastoid later reported positive for streptococci.

Jan. 26: Temperature: maximum, 104.1°; minimum, 99.4°. Had a severe chill and complained of severe pain in left shoulder and neck. Reflexes were normal. Eye grounds negative. Blood taken for culture.

Jan. 27: Blood culture negative. Marked swelling of shoulder, neck stiff. Had two chills during day. Blood taken for culture, a. m. and p. m.

Jan. 28: Blood culture negative (morning specimen); p. m. specimen positive for streptococci, showed 10 colonies on plate. Temperature: maximum, 105.1°; minimum, 98.4°; pulse: maximum, 124; minimum, 96; respiration: maximum, 32; minimum, 22. One

hundred c.c. antistreptococcic serum given, followed in a few hours by severe chill, subnormal temperature, and skin eruption (urticaria), delirium, shortness of breath and profuse perspiration. He went into shock and it was necessary to surround him with hot water bottles, stimulate with caffeine and sodium benzoate and the frequent use of adrenalin chlorid in 10 m.m. doses every hour for six hours. He rallied after the first hour and his temperature steadily rose to 103.2° . Pulse steadied and respiration came back to good volume. We were not able to discontinue the use of the stimulants for the next three days because of the tendency to recurrence of the urticaria and the shock symptoms. We found after we had given the antistreptococcic serum that he remembered an attack of diphtheria fifteen years before in which he had had two injections of serum.

The problem of further treatment arose. We could not give more horse serum and we were skeptical about the use of human blood, fearing more reaction.

Jan. 29: Temperature: maximum, 103.4°; minimum, 99.1°. Blood culture both a. m. and p. m., positive. C. B. C.: Hb., 62; reds, 3,350,000; whites, 13,500; polys., 68 per cent. Had severe chill during the morning. Gave 25 c.c. 1 per cent mercurochrome intravenously.

Jan. 30: Temperature: maximum, 103.4°; minimum, 99.1°. No chill. Blood culture positive. Twenty-five c.c. 1 per cent mercuro-chrome intravenously.

Jan. 31: Temperature: maximum, 100° ; minimum, 98° . Blood culture negative.

Feb. 3: Temperature normal, blood culture negative, and remained so until his discharge from the hospital on Feb. 14. Wound continued draining for two or three weeks.

Summary: This case is interesting because of the type of treatment which we were forced to use because of anaphylaxis.

Case 5: L. E. B., school boy, age 8 years. This case was one treated by my friend and colleague, Dr. W. O. LaMotte, who has permitted me to report it. The patient was first seen by Dr. LaMotte on Oct. 9, 1924. At that time he stated that about three weeks before he had a pain in the left ear lasting two days, followed by a bloody discharge, which changed to a heavy yellowish discharge by the third day and had continued to the time of his visit. Two days before he noticed a swelling in front of the ear. No pain at time, and did not complain at any time during his illness.

Examination: Purulent discharge from the left ear, preauricular swelling extending to the external canthus and below the left lid. The patient was seen again on Oct. 11, and had some swelling behind

the ear and a little tenderness. Temperature, 99.4°; pulse, 88. Mastoidectomy done under ether that day. C. B. C.: Hb., 82; R. B. C., 4,260,000; W. B. C., 10,500; polys., 73 per cent. Bone behind mastoid process was found very thin. Randall's gouge went through inner plate and punctured the lateral sinus; mastoid cells exenterated. Hemorrhage stopped by packing with strip of plain gauze and very little blood lost. Pus found in mastoid antrum, drained with iodoform gauze.

Oct. 13: Temperature ran little over 100°; less swelling of lids. Dressing changed.

Oct. 14: Temperature ranging from 101° to 104.2°; pulse, 100 to 124; respiration, 24 to 28. Blood culture positive for hemolytic streptococci.

Oct. 15: W. B. C., 14,000.

Oct. 16: Blood culture positive. Temperature and pulse still irregular. Reoperated. Removed sinus plate, found thrombosis. Ligated internal jugular, and clot removed, free bleeding from both ends. Found zygomatic abscess.

Oct. 17: Fifty c.c. antistreptococcic serum given intravenously. Temperature ranging from 101.2° to 104.1°. Dressed.

Oct. 18: Ten c.c. antistreptococcic serum given. Temperature ranging from 102.2° to 100°. Dressed.

Oct. 20 and 21: Dressed. Temperature ranging from 100° to 101°. Oct. 22: Temperature ranging from 100° to 98° and did not exceed 100° for next few days.

On Nov. 1 temperature reached normal and remained so until patient was discharged on Nov. 5. Wound healing. Blood culture was negative on Nov. 3. Patient was seen on Dec. 3. Hearing was good and ear dry.

Summary: This case is particularly interesting to me because of the treatment given. This child had 60 c.c. of serum and practically no other treatment: He had a positive blood culture on two occasions after the last dose of serum, with a temperature not very high. My feeling is that we could do with much less heroic or intensive treatment in these cases, watching, of course, for abscess formation and other complications.

307 Medical Arts Bldg.

SUBCUTANEOUS NEUROTOMY OF THE EXTERNAL NASAL NERVE FOR PERSISTENT PAIN AND TIC. REPORT OF A CASE.

Dr. EDWARD F. ZIEGELMAN, San Francisco.

The English word "pain" is derived from the Latin "paena," meaning penalty. It denotes pathology. This may be local, distant or systemic. It is Nature's method of warning the individual that structural changes are taking place, beyond those of normal physiological limits. These changes may be gross, microscopic or ultramicroscopic. Such structural alterations, which can be demonstrated grossly or microscopically, give little trouble as a rule insofar as diagnosis and treatment is concerned. In those conditions where ultramicroscopic changes have taken place, the reverse is true. They include that great group commonly called functional. This nomenclature is the result of our limitations and inability to determine such pathology; consequently such conditions become fertile field for philosophical thought and dissertations.

Scientific investigation is gradually opening this field to the medical profession. Progress in the functional disturbances depends upon the physicist and chemist. Our ability to correlate their researches and apply them in a practical way to the science and art of medicine and surgery is the hope of the future. Too great homage cannot be paid to the neuroanatomists, particularly Kuntz and Larsell, for their laborious work in clarifying some of the anatomical problems involved. The pioneer work of such master neurosurgeons as Cushing, Frazer, Adson, Dandy and others is well known for their ability to correlate anatomical and pathological observations with the clinical findings of neurogenic disturbances.

Neuralgia and neuritis are terms used synonymously. Fundamentally, they are not the same. The difference is one of pathology, and manifests itself clinically; but for all practical purposes it is ignored. The terms are used in a synonymous way and serve to characterize a symptom common to both: that is pain. All sensory nerves are subject to the variations: on the one hand, neuralgia; on the other, neuritis. Certain nerves are more prone to demonstrate these characteristics than others, notably those of the extremities, and to a lesser degree the cranial nerves, especially the fifth and ninth, with

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, April 25, 1932.

their branches. Trigeminal and glossopharyngeal manifestations are well known examples.

When the subject of neuralgia or neuritis and the sequela of such nerve pathology is discussed, we are inclined to think of them in terms of the main trunk, and to neglect to consider that any of the terminal branches may be involved, exclusive of the main trunks. This in a measure is due to understanding and knowledge of the trigeminal nerve with its pathology and success as to treatment. Since the pathology in this nerve and others is in many cases in the ganglion or main trunk, it is natural to think in those terms. Even though

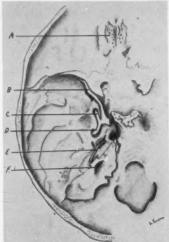


Fig. 1. Dissection by the author showing at (A) cribriform plate with crista galli, (B) ophthalmic nerve leaving skull at superior orbital fissure, (C) superior maxillary nerve and foramen rotundum, (D) inferior maxillary nerve and foramen ovale, (E) great superficial petrosal nerve, (F) the internal auditory meatus. The Gasserian ganglion has been removed with exception of its anterior portion.

such is the rule, at times patients present themselves in which symptoms are indicative of pathology in one or more of the terminal branches. It is true that the point of location is frequently difficult to determine. Nevertheless, the symptoms manifest themselves usually in the terminal branches. This has been well known for years in regard to the trigeminal nerve, in connection with the alcohol injection of one of the terminal branches of the fifth cranial nerve: the infraorbital at its exit from the infraorbital canal. True, many of these injections are only palliative; still a fair percentage are permanently relieved of their trouble by the utilization of this method.

Innumerable cases of peripheral neuritis seek relief for this condition. When the anatomical lesion has been definitely determined and proper advice given, if a serious surgical procedure is suggested, objection is the rule. Therefore, in most instances we are compelled to remedy the trouble insofar as we are able by the least amount of risk to the patient; both as to morbidity and mortality. If we are able to do this we have fulfilled an important duty.

Just as the infraorbital or terminal branch of the superior maxillary nerve manifests neuralgic symptoms, so do other branches of the same nerve. I have in mind the rather rare condition known as a neuralgia or neuritis of the terminal fibres of one of the branches of the ophthalmic. This is the external nasal nerve.



Fig. 2. Dissection by the author showing at (A) anterior ethmoid foramen, (B) masal bone, (C) the external masal nerve, (D) the superior lateral cartilage, (E) the inferior lateral cartilage.

The trigeminal or fifth cranial nerve has three main trunks, which serve as distributing pathways to the various structures supplied by this nerve. It is chiefly sensory. These three branches are: the first, or ophthalmic; the second, or superior maxillary; and the third, or inferior maxillary. The first two are probably entirely sensory. The third trunk is a mixed nerve, carrying both sensory and motor fibres. The sympathetic and parasympathetic are also probably distributed along the three main trunks. As this article deals with one of the terminal branches of the ophthalmic, only that nerve will be discussed. This main trunk arises from the anterior portion of the Gasserian ganglion as it lies in Meckel's fossa on the anterior surface of the tip of the petrosal pyramid. It enters the orbital cavity through the superior orbital fissure (see Fig. 1). It there divides into three

main branches, known as the frontal, lachrymal and nasociliary nerves. The nasociliary, as it courses through the orbit, gives off numerous branches, and ultimately leaves the orbit by way of the anterior ethmoid foramen to enter the cranial cavity (see Fig. 2). In this location, it passes forward on the cribriform plate and enters the nasal cavity through a small bony dehiscence at the lateral aspect of the crista galli (see Fig. 1). After traversing the nasal cavity for a short distance, it divides into an internal and external branch. The former remaining in the nose and supplying a portion of the mucous membrane of the lateral wall and septum. The other branch

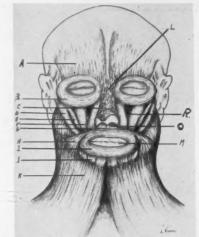


Fig. 3. Dissection by the author showing muscles of face and head. The superficial fat, fascia and skin has been removed. At (A) the frontal portion of the occipitofrontalis, (B) orbicularis oculi, (C) external nasal nerve, (D) zygomaticus major, (E, F, G) the three bellies of the quadratis labli superioris, (H) the triangularis, (I) orbicularis oris, (J) submental muscles, (K) platysma, (L) procerus, (M) mucous membrane of lip. (O) depressor septi, (R) portion of caninus under the quadratis labi superioris. This dissection shows the superficial course of the external nasal nerve.

makes its exit to supply portions of the external nasal surface. This is at the place of junction of the respective nasal bone and superior lateral cartilage, approximately 1 c.m. external to the midline (see Figs. 2 and 3). At this point of exit from the nasal cavity, it lies beneath the procerus muscle, traversing this structure to become very soon superficial, beneath the subcutaneous tissue (see Fig. 4). In such manner it is distributed to the lower lateral aspect and nasal tip. A thorough anatomical knowledge of the point of exit of this nerve from the nose is essential insofar as treatment is concerned.

A knowledge of the course of the ophthalmic branch from the Gasserian ganglion to its ultimate distribution is of great importance in visualizing pathology that may cause symptoms in its terminal branches. Any treatment of the external nasal nerve at its point of exit from the nose either in the form of injection or excision, will affect its distal fibres accordingly, depending upon the correctness of the diagnosis and the virtue of the type of therapy used.

External nasal nerve neuralgia or neuritis is not common. Nevertheless, it occurs at times. Its etiology is similar to such pathology as occurs in other nerves. It may be classified in the category of

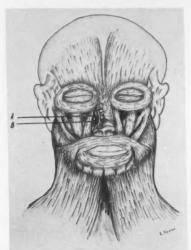


Fig. 4. Dissection by author as shown in Fig. 3. The procerus muscle has been separated and partially removed to show external nasal nerve as it passes forward to become superficial. (A) Procerus muscle separated, (B) external nasal nerve.

focal infections, metabolic disturbances, the various neuroses; or the local manifestation of local or systemic pathology. New growths, impinging on the nerve as it passes in the cranial cavity on the cribriform plate, must not be lost sight of. This is especially true of the meningeomas or endotheliomas, that occasionally occur in this region. The writer has had the rare opportunity of seeing such a case, demonstrating external nasal nerve symptoms; and at necropsy an endothelioma of the dura over the cribriform plate was demonstrated. For all practical clinical purposes we may consider that focal infections probably play the chief rôle in this, as in other types of neuralgia.

When the external nasal nerve is involved, excruciating pain in the lateral side of the inferior aspect and tip of the external nose is complained of. At times, it may be intermittent, of a very sharp character, simulating the tic type. At other times, a hyperesthesia or parasthesia may be present. The diagnosis is self-evident from the subjective symptoms described. The various neuroses must not be lost sight of. Meticulous care in endeavoring to eliminate all causative agents, before resorting to local treatment, is self-evident.

Insofar as treatment of an external nasal nerve neuralgia is concerned, the fundamentals applicable to neuralgic or neuritic conditions in other nerves is indicated. They are systemic and local. Systemic in endeavoring to determine and remedy sources of metabolic disturbances, focal infections, general systemic diseases, recognition



Fig. 5. Drawing to demonstrate technique of severing external nasal nerve, (A) curved, pointed tenotomy knife inserted at (B), the superficial incision.

of new growths, as previously explained; and when necessary advice should be given as to causative agents that might bring about the various neuroses, such as exhaustion.

Locally, the use of heat, galvanism, injection of alcohol or other agents directly into the nerve may be tried. Usually, one or all of these remedies answers the purpose. At times, all local and systemic remedies fail. Then resort should be had to severing the nerve by the subcutaneous technique. In such manner immediate relief is obtained. The technique of this method is simple and is as follows: First, determine the anatomical point of exit of the nerve (see Fig. 4). At this location inject 1 c.c. of 1 per cent novocain or other suitable local anesthetic with a minute quantity of adrenalin chlorid. After allowing 10 minutes to supervene, a small incision in a longitudinal direction is made. This incision need not be over 5 m.m.

long. With a mosquito forceps the soft tissues are gently separated. A blunt-pointed, curved tenotomy knife is inserted into the incision down to the cartilage. It is then carried outward, passing beneath the nerve. It is then brought forward. In this manner the nerve is severed (see Figs. 5 and 6). The separation of the muscle fibres is not necessary if one is sure of their anatomy. In explanation of the technique, one can compare it to that used in severing the tendo achillis in talipes calcaneus; a favorite procedure of orthopedic surgeons. Postoperative treatment consists in closing the wound with a small quantity of flexible collodion. The result is most satisfactory when properly performed in indicated cases.

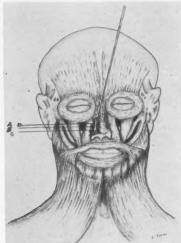


Fig. 6. Drawing to demonstrate on dissected specimen the method of severing external nasal nerve. (A) Procerus separated with knife under nerve, (B) separated muscle, (C) external nasal nerve.

Following is the report of a case of external nasal nerve neuralgia, treated by the aforementioned technique: Mrs. K., widow, age 53 years, consulted the writer in January, 1929. Chief Complaint: Excruciating, intermittent pain over the area of distribution of the right external nasal nerve. Family History: Irrelevant. Past History: Negative, with exception of having had a Colle's fracture 10 years prior.

Present Illness: For past three months has had persistent pain over the area of distribution of the right external nasal nerve. No other complaint.

Physical Examination: A well nourished female, somewhat obese. General Physical Examination: Negative, with exception of two poorly fitting gold crowns and embedded septic tonsils. There was a tendency to an icteroid appearance of the conjunctiva.

B. P.: Sys., 140; diastol., 90. Otherwise her physical examination as to her nervous, gastrointestinal, genitourinary, cardiovascular,

gynecological and orthopedic systems were negative.

Laboratory Findings: Wassermann, negative; urine, negative; blood count, normal. Hg., 90; B. M. R., —6. X-ray of teeth showed three abscesses. Sinuses, negative. G. I. X-ray showed poor gall bladder emptying time, evidence indication of a chronic cholecystitis.

Treatment and Advice: Local tonsillectomy performed by the writer. Referred to dentist; three teeth extracted. Three months after this work was completed, no improvement in her nasal nerve pain. Explained her gall bladder condition and the wisdom of removal. To this she would not consent. Then did local alcohol injection. Relief for three weeks. Pain recurred. Suggested possibility of some condition intracranial in region of cribriform plate causing pressure. At this time she frankly stated that she was desirous of getting permanent relief for her pain. Would not consider further X-ray or any surgery on her gall bladder. Subcutaneous external nasal nerve neurotomy was then suggested. To this she consented after explaining the method and possibilities. This was done June, 1929; five months after first consulting me. During this time she had consulted other men, who had given her advice similar to that given by the writer.

Follow-up Record: Has had no recurrence of trouble during the past two years. The anesthesia which she at times complained of has been gradually improving. Was last seen November, 1931. At that time she stated that she was feeling fine; anesthesia over lateral aspect of nasal tip is not present subjectively; but can be determined to a slight degree objectively at the present time.

CONCLUSIONS.

I. External nasal nerve symptom is an occasional occurrence.

2. After thorough investigation, if no relief is obtained by other methods, subcutaneous neurotomy is indicated.

3. It is a simple procedure, can be done under local anesthesia and gives excellent results when indicated.

4. It should only be performed as a last resort.

The temporary presence of postoperative anesthesia in the area supplied by the severed nerve gradually adjusts itself.

450 Sutter Street.

DIETETIC TREATMENT IN CHRONIC SINUS DISEASES.*

DR. E. V. ULLMANN, Portland, Ore.

The treatment of sinus diseases of today has practically been directed only by surgical methods. Although we can read in most textbooks that general treatment and hygiene should be applied, very little attention has been paid to that side of the treatment, and the physician is left without definite directions to his own judgment. Every rhinologist comes across cases which have been operated upon a great many times without the desired results, and the patient may often have been just as well off without any operation.

While it is true that in certain cases a sinus infection acts as a focus for distant disorders, we should be cautious to generalize this statement. Most of the chronic sinus cases which do not yield to operations must be looked upon as systemic diseases. Within the last decade we were inclined to see in every sinus suppuration an infection, therefore concluding that it was a possible focal infection. We know that bacteria can be found in every nose, whether diseased or not. Why, therefore, can we not reverse the question of our problem and ask, what changes are taking place in our system to bring the mucous membranes of the nasal cavities into a condition which permits there saprophytes to propagate? It has never been proved that one particular bacterium is causing a sinus infection, a statement which does not prevent the observation of cases which, de facto, proved that occasional sinus infections were due to a specific streptococcus, pneumococcus, or even spirocheta. It is also evident that we cannot remove the focus of infection in a pansinusitis, because of the impossibility to exenterate all ethmoid cells, even with the most minute technique. We see, indeed, that the research of the last few years is inclining more and more towards the direction of finding facts, which may lead us to recognize the changes in the system and mucous membranes rather than toward the overestimated focal infection.

In the following paper I will give my experiences with a diet I have applied within the last year to patients suffering from chronic sinus diseases. The cases which I chose for these dietetic experi-

^{*}Read before the Central Willamette Medical Society, March 3, 1932. Editor's Note: This ms. received in Laryngoscope Office and accepted for publication March 12, 1932.

ments were all chronic sinus cases, where more than one sinus was involved and all of which had undergone numerous operations without the desired results. They all still complained of abundant discharge, at times showing small multiple polyp formations around the sinus ostia, and had consecutive pharyngitis or bronchitis. In some of these cases definite rheumatic or neuralgic complaints were present. Five of the 33 cases of my series were children with pansinusitic symptoms, three of them have previously been operated on the maxillary antra (window operation). I would like to state here that the best results I obtained were in these children. First, I excluded all acute cases, because, one might say, that an acute condition could have disappeared with or without treatment. In none of the cases was a closed empyema present. In examining the urine of these patients, I found that practically all of them had a strong acid reaction on a 24-hour sample, and the hydrogen-ion-concentration showed a marked decrease around and below six, while the titration acidity*, as well as the ammonia content were increased.

None of the cases showed evidence of allergic symptoms, as eosinophilia or a tendency to asthma. I tried at first not to include allergic patients in these experiments, as they seem to react in the opposite way, which means toward alkalinity.

The question came to me: Should one be able to influence the biological reaction of these patients by a diet? In all of the chronic cases we have to deal with exudation from the mucous membranes, a low resistance against infections, and readiness from the side of the patient, to react with more or less indefinite and vague pains, which they call either neuritis or arthritis. In the salt-poor diet, as advised by Gerson¹-Sauerbruch², I found a diet which seems exactly to counteract these reactions.

What are the characteristics of this diet? The main characteristic is the poorness in N_aCl . Contrary to most of the salts in our food, N_aCl is free of oxygen, consisting only of the metal sodium and the acid former chlorin. While the sodium of the salt becomes useful for the body in exchange against other bases, the chlorin is of no use as a body builder. On the other hand, we do not know of any chlorin-containing organic matter in the body, and wherever we find this acid former in the organism or food, we find it bound to a metal. The function of N_aCl in the organism is the following: Proteins, insoluble in pure water, for instance, these of the blood, are kept soluble by the contents of N_aCl , which normally is between 0.05 to 0.1 per cent. Furthermore, the content of N_aCl in the body fluids

^{*}Around and above 350 c.c. N/10 acid per 24 hours.

determines the osmotic tension and, finally, it is necessary for the production of hydrochloric acid in the stomach. This latter amount of N_aCl , however, is not lost to the organism, because it will be changed again into N_aCl in the intestines and thereby given back to the tissues.

Inasmuch as the loss of N_aCl is normally very little, we need only a small quantity of N_aCl in our food. If we live on the N_aCl, contained only in the natural food we take in, we cover the above mentioned needs in a sufficient amount. One of the best authorities on the question of salt metabolism, Strauss³, estimates the daily needs of an adult person from 1 to 1.5 g.m. The average normal person, eating as we all do, will take from 15 to 20 g.m., in excessive cases as much as 25 g.m.

People who are taking such enormous amounts of salt and are constitutionally not able to eliminate it accordingly, can be looked upon as living pickles. I may quote here the observation of R. Berg⁴, who examined such an individual before and after a five-month salt-free diet, finding that he then still eliminated a daily amount of about 12 g.m. of N_aCl. We may call attention to the fact that each gram of N_aCl will retain 70 g.m. of water in the tissues. It is known that a person of about 150 pounds weight can retain in his tissues easily about 4 liters, equal to 1 gallon of water, without showing edemas. Most of this water will be eliminated when the intake of N_aCl is reduced. The reduction of N_aCl, therefore, must have a dehydrating effect and counteract in this way the tendency to exudation.

The second point of importance in the reduction of NaCl lies in its relation to calcium. It has been shown by biochemical experiments that the kation sodium will expel the kation calcium. If we eliminate sodium in the intake, the biological effects of calcium in the tissues will prevail. In other words, the negative effect of the elimination of NaCl will become manifested through a positive effect of the calcium concerning inflammatory reactions, and therefore will work antiphlogistically. We then can readily understand why the dosage of calcium in whatever form it is given will remain without therapeutic effect, if it is given without a salt-poor diet. It is strange to note that in a recent article of J. C. Hoyle⁸, which gives an excellent review of the calcium metabolism in relation to therapeutics, no attention is paid to the diet which is applied during the calcium therapy. This much is certain, that the success of any calcium therapy and the form of nutrition are closely related. We should not figure on being successful with a calcium therapy if we do not at the same time reduce considerably the NaCl. According to v. Noorden⁶, a person can accumulate about 2 g.m. of CaO per week for two consecutive weeks, in the blood as well as in the tissues, if no N_aCl is given and the patient is fed on an alkalin diet. During the following weeks the increase of CaO in the blood and tissues will be less.

It has been shown that calcium is precipitated by citric acid. When a calcium specimen is given orally, one should leave out all citric acid, as lemons, oranges and grapefruit, at least from the meal at which calcium is being taken, in order not to neutralize the effect of the calcium.

Examinations by Urbach⁷ have shown that the chlorin content of the skin, mucous membrane and blood, showed a marked increase during various inflammatory conditions. I do not want to go into the details of the examinations, because they seem to only have a conditional value, inasmuch as our present day chemical methods indicate the total chlorin, whereas we deal in the salt-poor diet with the molecule NaCl. Marchionini and Ottenstein⁸ proved that the NaCl content of the blood would decrease during a ten-day period of a strictly salt-free diet, from 600 to 521 m.g. per cent. The normal NaCl content of tissues ranges from 200 to 300 m.g. per cent, at the maximum. These authors found that it can mount in patients carrying an inflammation and fed on a normal diet with an intake of about 15 to 20 g.m. of NaCl daily, as high as to 631 m.g. per cent. Experiments of Wahlgren® and Padtberg10 demonstrated that the skin will accumulate about one-third of the total NaCl. If on a saltpoor diet the total NaCl in dogs will decrease about 11 to 12 per cent.

The question whether it is the kation sodium or the chlorin alone or only the combined molecule of both which is the damaging factor is still a problem for the biochemists. From this point of view, several salt supplements have been manufactured, some of them being free of sodium, some free of chlorin, and some of them free of sodium chlorid. I do not want to pass my judgment on any of these preparations, because it seems that one can get along without them, if one just informs the dietitian or the patient how to prepare the food. It is not difficult to understand that a prolonged salt-poor diet will become boresome and unappetizing, if nothing at all is done to replace the salty taste for people who have been accustomed to it.

There is no need of restricting fluids, as the elimination of salt normally has a diuretic effect and one hears often from the patient that he is urinating far more than ordinarily. v. Noorden reports that he observed cramps in cases where fluids were restricted.

The second point of importance in the diet is whether the diet should be alkalin or an acid one. This has to be determined by the amount of acidity the patient's urine will show. I do not want to state that the acidity of the urine is characteristic to all chronic cases, but certainly the majority of them will show a very acid reaction. However, one should direct the diet in such a way as to keep the urine reaction of a 24-hour sample neutral.

All of those who followed the literature will be somewhat puzzled by the statements of the two sides; one, that the diet is an acid one (Sauerbruch), and the other, that the diet is an alkalin one (R. Berg and Gerson). To understand that we want to define, first, what acid food really means. We consider the acid value of the food in three ways: 1. As the value of taste; 2. as the chemical value of ash; 3. as the biological effect value. These three factors are not necessarily interconnected. Most fruits have an acid taste and an alkalin effect, because the organic acid will be burned to CO₂, the latter being eliminated by the lungs without much burden to the total metabolism. There still remains a surplus of inorganic bases, leading towards an alkalin effect.

The usual division of alkalin food and diets is done by its chemical ash value. We call an acid diet one which produces after burning a surplus of acid equivalents, and we call it a basic one, if it burns with an alkalin surplus. But biologically and therapeutically, however, this represents only a conditional value. The difference of external conditions is the cultivation of the food, the type of ground and fertilizer, the influence of conservation and especially the technique of cooking, have a very important influence on all foods and may change the anion-kation-balance fundamentally. R. Berg, for instance, has proven that alkalin vegetables can be changed into acid formers, if they are boiled for a long period of time, but will keep their basic surplus if they are only steamed. Some of the canned goods are prepared with bisulfit, boric acid, benzoic or salicylic acid. These acids are so strong that even if taken in minute amounts they will leave an acid surplus.

By the biological effect value we can divide diets and nutrition into acid and basic working ones, in this way naturally neglecting the taste altogether and the ash value at times. The feeding of food with an acid or basic surplus does not necessarily involve a change of the metabolism into an acid or basic direction, nor does the change of the metabolism to either direction permit the conclusion that the food had been an acid or an alkalin one. From this point of view, Kroetz¹¹ introduced the conception of the biological effect value, meaning only that this diet has an alkalotic or acidotic effect. It is the biological effect which in the end will always be the main object of the therapy.

The best method to estimate the acidity is the estimation of the hydrogen-ion-concentration of the urine, expressed as a Ph figure. One can either use the method of Klett-Beaver, which is a little more expensive but furnishes a ready colorimeter, or the less expensive method of Mansfield-Clark¹², using Buffer standards with appropriate indicators added. The descriptions of these methods will be found in the excellent book of "Laboratory Diagnosis," by Osgood and Haskins¹³, both of the University of Oregon.

It also is necessary, in order to control the diet, to examine the total chlorids in the urine before the start, and then check it from time to time. The total chlorids during a normal diet in a normal person approximately amounts to 6-8 g.m. per day in a 24-hour specimen. It should decrease within three to four days after the inset of the diet to 2.0-2.5 g.m. per day per 24-hour specimen, and even less. In exceptional cases, as mentioned before, it may take longer to reach that point. In these cases, however, the patient should be kept on a strict salt-free diet until this point is reached.

We know today that the actual reaction of the blood, which can be measured by the determination of the Ph, is a biological constant, called the acid-basic-equilibrium. This equilibrium can be changed by physiological actions of various forms temporarily a little bit toward one or the other side, but will be regulated within a very short time into the normal again by a highly differentiated regulative mechanism. The excretions of the lungs, kidneys, intestines and skin are all contributing to this function. By more or less expiration of carbonic acid, it is possible for the organism to decrease at once its acid surplus and, respectively, to increase the alkalin surplus by accumulating the bicarbonates. Only in extreme cases, agony or diabetic coma for instance, is this equilibrium definitely changed.

Acid and basic food can change the absolute amount of free and fixed carbonic acid, but neither one can change their relationship. We, therefore, cannot expect after feeding different diets for a long period of time to change the actual reaction of the blood, but we can influence the alkalin reserves of the blood that means the difference between the basic and acid value, *i. e.*, the alkalin reserves will be decreased in acid diets and increased in alkalin diets.

As previously mentioned, some authors emphasize their diet being an acid one, and others feeding an alkalin one. If we study what they are feeding, they seem to give practically the same, with the exception that Gerson eliminates all meat, while Sauerbruch allows meat in moderate quantities of about 600 g.m. per week. Which of the two opinions is correct is difficult to decide, as long as we have

no other way than to conclude by the biological reactions of the tissues. The actual reaction of the arterial blood always remains the same. The tissues, however, accumulate an inorganic and organic surplus material far more than the blood, and it seems that the skin and mucous membranes are ranking first in that respect.

In a very recent publication W. F. Wenner and P. R. Nemours¹⁴ demonstrated the results of experiments with rabbits. They showed that after an artificial increase in the Ph of the blood, calcium combining substances, irrigated upon the mucous membranes of the sinuses, lead to the disappearance of cilia from the epithelium and to a marked infiltration of eosinophilic leukocytes. This seems to agree with previous examinations that in allergic cases we have to deal with a tendency of the metabolism towards alkalosis, while the cases of my material, excluding allergic conditions, showed an acidotic component.

Coming back again to our problem concerning the diet in sinus cases, it may be interesting to refer to the work of D. C. Jarvis¹⁵. who, in an elaborate study of approximately 500 people, observed that the acidity or alkalinity of a given food has an influence on the clinical appearance of the mucous membrane of the nose. His guiding point was the redness of the nasal septum. He classifies the color with 1, 2 and 3, using that way a very subjective guide, which makes it rather difficult for two different examiners to compare their results. On the other hand, his observations are leading in the same direction as mine, that the reaction of tissues and fluids of the organism may give us one more key for the treatment of sinus diseases. I have tried to balance the diet so that I kept the urine acidity around neutral. That means that the Ph was kept around seven. As I have said before, practically all cases, at first, are quite acid. However, I tried by proper balancing the diet to prevent the urine reaction from reverting too much to the alkalin side.

Most men, at present, agree that nearly every type of diet, whenever kept over too long a period of time, may be of harmful consequences. It is well known that if an extreme alkalin diet, as, for instance, the Sippy or Balint diet, are kept up too long a time, they may lead to tetanic symptoms. Therefore, the patients should not be allowed to continue one type of food too long. It is not at all necessary to do so, in order to obtain results. The variations in the regulation of the diet can be roughly described as follows: At the outset of the diet the restrictions should be very drastic. Practically salt-free and mostly, as mentioned before, consisting only of vegetables and fruits. To describe the preparation of the food would

lead far beyond the limit of this paper, and I have to refer to the literature. The gastric and intestinal condition, eventually other metabolic diseases, as diabetes, gall stones, gout, etc., should be taken into consideration as to whether raw or cooked fruits and vegetables only will be given, or both. Within its given limits also this diet naturally will have to be adapted to the individual. Food value, digestibility and personal likings should be considered as much as possible. Around the fifth to tenth day a marked improvement usually is reported by the patient. At that point it is advisable to let the patient return, at least partly, to his natural diet, with a limited amount of salt (not more than 2 to 3 g.m. daily). For the following three to five weeks the patient must observe at least two days of restricted diet per week, after this period he will be allowed to observe but one restricted diet day per week. This arrangement seems in most cases to be sufficient, in order to eliminate enough salt of the organism, to keep the reactions of the mucous membranes relatively free of clinical symptoms. We may call that a "zigzag" diet. v. Noorden emphasizes that a sudden change in diet is always becoming to a patient suffering from chronic disorders with manifest clinical symptoms. We find, indeed, that such a fact must have been known in the olden times, as we see that "fast days" and restrictions of diet during certain "holy days" have been customary in every creed, sect and religion.

As mentioned before, a urinalysis is done on the onset of the diet, determining the Ph and the chlorids, and should be repeated weekly. For practical purposes these two factors will be a satisfactory guide for the further regulation of the treatment. In children and weakened patients I am giving about three tablespoons of cod liver oil. No other drugs are given, unless a special condition calls for it. Local treatment was applied before the diet was started, whenever nasal breathing was impaired. During the diet only then, when discharge was so heavy that washing the sinus was imperative. It goes without saying that all sinuses should have a proper drainage.

It may be well to call attention to the fact that I obtained much better results, since I send the patients to a hospital for about seven to ten days, where they have a good diet kitchen. It was evident to me that this diet cannot be carried out at home as well, because, outside of information, intelligence, fantasy and experience in cooking, it is absolutely necessary that the food tastes so that the patient will not refuse it at once. After the patient once sees his improvement, especially those who dread another operation, they are willing

to do anything, and one can obtain their co-operation to a much better degree.

When a patient, after having reached the mildest form of diet, felt that he had caught cold, or complained of pain in his muscles or joints, he was told to start again with the strict form of diet for a week or ten days.

I certainly do not emphasize that this is an all-cure for sinus diseases, but I do want to say that in every case in which we do not have to deal with a closed empyema and have no definite proof of retention of free pus, this type of treatment should first be carried out before another, a third or a fourth operation is performed.

In conclusion, I want to emphasize the evidence of the fact that not a single patient ever will be harmed, but the majority of them will benefit if the procedure of treatment is as outlined.

- Gerson, M.: Meine Diat. Berlin, 1930.
 SAUERBRUCH, F.: Wundinfection, Wundheilung und Entzeundung. Muench. med. Wo., 38, 1924. Stellungnahme zu Gerson, etc. Med. Welt, page 1351, 1929.
 - 3. STRAUSS, H.: Med. Klinil. Vol. 36, 1929.
- 4. BERG, R.: Grundlagen einer richtigen Ernaehrung. Dresden, 1930; seventh edition and previous publications of same author.
- 5. HOYLE, J. C.: Some Aspects of Calcium Metabolism. The Practitioner, 1930 Periodical.
- 6. v. Noorden: Ernachrungsfragen, J. Springer, 1931. Ueber Obstkuren und Ueber Rohkost, Therapie d. gegenwart, July, 1928. Ueber Zick-Zack-Kost.
- Ibidem, Vol 1, 1931.
 7. Urbach, E.: Hautkrankeiten und Ernaehrung. Wilh. Maudrich, Vienna, 1932.
- 8. MARCHIONINI und Ottenstein: Ztschr. f. d. ges. phys. Ther., 40:99, 1932.
 - WAHLGREN: Arch. f. exper. Pathol., 63:97, 1909.
 PADTBERG: Arch. f. exper. Pathol., 63, 1910.
- 11. Kroetz: Muench. med. wo., page 1788, 1929.
 12. Mansfield, Clark W.: The Determination of Hydrogen Ion, Edit. 3, page 717, Willian and Wilkins Co., Baltimore, 1929.
- 13. Osgood and HASKINS: Laboratory Diagnosis. P. Blakistone Son & Co., 1931.
- 14. NEMOURS, P. R., and WENNER, W. F.: Arch. Otolaryng., Vol. 15, 270,
- 15. JARVIS, D. C.: Annals of Otology, Vol. 39, June, 1930.
 - 740 Medical Arts Building.

International Digest of Current Otolaryngology.

Editor:

DR. MANWELL FINEBERG, St. Louis.

Collaborators:

Prof. G. Bilancioni, Rome.

Mr. W. S. Daggett, London.

Priv. Doz. G. Kelemen, Budapest.

Dr. H. C. Rosenberger, Cleveland.

Notice has been received from Prof. Tapia, of Madrid, that plans and program are now being completed for the Second Annual International Congress of Oto-Rhinology and Laryngology which will be held in Madrid, Sept. 27-30, 1932.

The scientific program will consist of three symposia on Otosclerosis; Ozena and Scleroma. These will be participated in by some of the foremost international specialists. In addition to the above subjects, there will be several other topics and papers.

An elaborate social program is being prepared and visitors to the Congress will be shown many interesting landmarks of old Spain.

Arrangements are being made by a travel bureau to conduct a tour for American physicians, which will also include attendance at the Madrid Congress.

Notification of attendance should be sent to Dr. A. Fumagello, Hermosilla 2, Madrid, Spain.

An unusual method for the removal of a foreign body from the lung is reported in the Department of Foreign Letters, *Jour. A. M. A.*, Nov. 7, 1931, page 1397. A child, age 6 years, had swallowed a metal ball-bearing, which had passed into the lung and set up a pneumonia. Mr. Bell Tawse, the laryngologist in charge of the case, decided that the best method of removal would be to magnetize the body of the child, and then by means of a bronchoscope reach the foreign body and extract it. The boy's body was then put in the middle of a powerful magnetic field, the ball was located by means of the bronchoscope and a iron rod passed to the ball through the bronchoscope; the ball clicked to the iron rod and was easily removed. This apparently is the first recorded case of foreign body removed from the lung by means of an electromagnet and bronchoscope.

Richey, of Pittsburgh, in the Jour. A. M. A., Feb. 27, 1932, discusses pneumococcus pseudomembranous pharyngitis. He reports the clinical history of five cases, two of which began as acute stomatitis. The symptoms of the condition are constant and consist of a severe sore throat, salivation, dysphagia and cervical adenitis. The condition is characterized by a white, tough, adherent, odorless sheet of fibrin; it is very similar to the diphtheritic exudate. Diagnosis must be made by bacteriologic methods. In all of his cases a typical pneumococcus was found. Richey obtained striking results in his cases by the topical application of optochin.

Osmond, of Cleveland, in the *Jour. A. M. A.*, Dec. 12, 1931, discusses accessory sinus infection in suspected pulmonary tuberculosis. His approach to the problem is mainly from the Roentgenologic aspect. In examining a large number of chest cases, he was impressed by the high per cent whose clinical symptoms suggested early tuberculosis, but whose X-rays revealed only marked hilus thickening. Some 50 or 60 per cent of these cases showed definite sinus involvement.

The author makes the plea for closer co-operation between the rhinologist and the internist for management of these borderline cases.

The January, 1932, issue of *Otolaryngologia Slavica* is devoted almost exclusively to the tonsil problem. The problem is gone into from every aspect and leaders in their respective countries have contributed portions to this symposium. Mention of this particular issue is made in this department chiefly because American authors may wish to use this volume for reference when looking up literature on any phase of the tonsil problem.

Notice has been received that the New York Academy of Medicine will hold its 1932 Graduate Fortnight, Oct. 17-28, inclusive. The theme of this year's conclave will be Tumors, Benign and Malignant. The medical profession of the country is invited to participate in this study. A full program has been arranged and many notable speakers obtained. Clinics and demonstrations have been arranged in the leading hospitals of New York City. There is no charge for attendance at any of the clinics or meetings, but registration is required for participation in the hospital demonstration clinics. Blanks may be secured by addressing the New York Academy of Medicine, 2 East 103rd street, New York City.

Bishop, DuBose and Hamlin, of Roanoke, in the Jour. A. M. A., April 30, 1932, describe what they claim is the second reported case in the literature of otogenous tetanus not associated with an injury of foreign body. Their reported case is of interest because it complicates recurrent purulent otitis media with recovery of bacillus tetani from the middle ear. There is a possibility that the middle ear is primarily a focus of a generalized tetanus.

Balyeat and Rinkel, of Oklahoma City, in the *Jour. A. M. A.*, April 30, 1932, report on a case of urinary retention due to the use of ephedrine. They say that the use of ephedrine in large quantities will not uncommonly produce various types of bladder symptoms, the chief one being the lack of desire to pass urine. They suggest that the urologist and general practitioner should always consider ephedrine as a possible etiologic factor in cases where complaint is made of lack of desire to pass urine or the retention of urine.

Rowe and Drury, of Boston, in the Jour. A. M. A., April 30, 1932, report a study of the failure of hearing in the young in a rural community. They examined 2,078 children, from a typical New England rural district, of whom 28 per cent (590) were found to have probable impairment of hearing. Hearing loss was confirmed in 276 cases, the others showing normal hearing. About 85 per cent of the impaired group demonstrated conditions correctible by the school health authorities. About 50 children had possible mental retardation for whom further diagnostic study was recommended. About one-half the children reported trouble with their ears as the chief complaint and practically two-fifths did not present any complaint whatever. The authors maintain that such a survey offers a simple and easily conducted approach to a betterment of the health level of a community and toward the solution of one aspect of the general educational problem.

Potts, of Omaha, in the Jour. A. M. A., Jan. 30, 1932, discussed thrombosis of the lateral sinus. His paper, written in honor of the late Dr. Harold Gifford, contains an historical account of the development of sinus thrombosis, particularly in and about Omaha and the part that Dr. Gifford played in its development in that locality. The paper is rendered increasingly interesting through the abstract of discussion which follows it.

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY.

Regular Meeting, Jan. 5, 1932.

Speech Training of Deaf Children. Carlotta A. Anderson, M. A.

It is a real pleasure to have this opportunity this evening of meeting and speaking to a group whose interests coincide at so many points with those of my own profession. You, as physicians, are perhaps primarily interested in the physiology and cure of the afflictions of the deaf and of the hard-of-hearing, but in a broader sense, as the trusted counselors and friends of those who come to you, you have also a vital concern with all efforts to overcome the hardships of the afflicted and to help them to live more normat, well rounded lives.

I would like to present briefly one or two ideas which have grown to be convictions with me during my years of experience with the deaf. What I have to say applies particularly to the young deaf child, for the beginnings of education are even more important when there is a handicap of deafness than when the child is normal.

First, I am sure that in many cases of deafness among children, perhaps in a great majority of cases—there is some residue of hearing, which can be developed by patient drill and practice early in the child's life, and which is of inestimable value in normalizing the child's speech and actions. So many times have I been surprised at the results obtained along this line that I now never allow myself to be persuaded that "nothing can be done about the child's hearing" until I have tried and tried, and tried again. Dr. Macfarlan can tell you much along this line.

Secondly, I have become convinced of the importance of giving the deaf child every possible opportunity to acquire language, but of the normal, every-day language of walking, working, playing, eating and sleeping—just as early as possible. The acquisition of language should not await the development of the child's ability to talk—the use of the written word so greatly enlarges the child's horizon and makes possible more rapid progress as the powers of speech and of lip-reading develop. No opportunity should be lost for interpreting to the child in normal terms the meaning of his daily activities and of the world around him. Extra effort is necessary to compensate for the loss of auditory sensations—those sensations which help the normal child to adjust himself to life. Hence, the young deaf child's education must be almost individualized but not at the expense of his physical, social and spiritual development.

These two principles—early and continuous effort to develop the hearing and the constant emphasis on language drawn from every-day life—are of primary importance particularly in the early stages of the deaf child's education. To do these things effectually under the average conditions of school attendance is difficult, for the teacher has, at best, only a few hours out of the child's day to work in. The environment is limited to the schoolroom, and there is no opportunity to tie in the training with the child's other interests. Long vacations and absences from school unquestionably retard progress. The ideal place for young deaf children to begin their education would be a small, all-year-'round school where the environment would be that of a normal home, with the added advantage of supervision and guidance by someone trained, not only in the technique of teaching speech and lip-reading but also in solving the peculiar problems of the deaf child of preschool age.

The Intranasal Tear-Sac Operation from the Standpoint of the Rhinologist. Dr. J. M. West.

The speaker discussed briefly the different surgical methods of approach to the lacrimal sac.

1. External: a, Extirpation of the sac; b. the dacryocystorhinostomy of Toti, LaGrange, Mosher and others.

Internal: a. Through the antrum (v. Eichen); b. through the mouth (v. Eichen).

Intranasal: a. Caldwell, b. Passow, c. Strazza, d. Okuneff, e. method

of Veis, f. trans-septal, g. speaker's procedure.

The speaker described the technique of his procedure with diagrams and lantern projection. Also a large collection of photographs of cases of mucoceles of the tear-sac, lacrimal fistulas and phlegmons of the tear-sac were shown, with lantern projection, demonstrating how the intranasal operation cures the conditions.

The operation consists of a complete resection of the lacrimal sac intranasally. The principal advantages of the procedure are: 1. Total removal of tear-sac, 2. Normal nasal drainage is re-established, so that the tears drain off into the nose, thus securing a dry eye. 3. This restoration of nasal drainage causes the pathogenic bacteria to disappear from the conjunctiva sac. 4. External incision is avoided.

On account of the danger of infection the elimination of the pathogenic bacteria from the conjunctiva is especially important in cases where an intrabulbar operation (cateract, discission, etc.) is to be done later. In contrast, it has been found in Axenfeld's clinic, that after the external extirpation of

the sac, the pneumococci persist in 43 per cent of the cases.

The Indications for the Operation: The intranasal lacrimal sac operation is indicated in all the different clinical conditions caused by dacryostenosis, that is, in dacryocystitis with or without dilatation of the sac, in lacrimal fistula, in phlegmonous conditions, and also in epiphora of nasal duct origin. Ulcus serpens with dacryocystitis. Also chronic blephasitis combined with suppuration of the sac, and often practically incurable by other methods, such as the external extirpation of the sac, followed by treatment directed to the conjunctiva, usually disappears after nasal drainage is restored by the internal method. The operation is also indicated in cases of dacryocystitis or epiphora due to traumatic stenosis of the canal, following injuries of the nose, or resulting from operations on the maxillary antrum. Also many patients suffering from epiphora consequent to the external extirpation can be cured by the intranasal procedure. Finally, in cases of cataract, etc., which require an intrabulbar operation and which are complicated with a dacryocystitis, it is safer to remove the lacrimal sac by the nasal route than to extirpate it externally.

DISCUSSION,

DR. PETER: From an ophthalmological standpoint, which furnishes the basic reason for surgical interference, one must consider the indications for surgery. Excision and obliteration of the sac by chemicals are indicated, first in acute corneal conditions; second in the presence of an advanced pyogenic state of the lacrimal sac in dacryocystitis of long standing and, third in the presence of chronic pathology of the nasal cavities.

In the first instance one may be able to postpone radical measures by closing the punctae with the cautery. When the sac is chronically involved temporizing may be inadvisable and excision may be indicated. Drainage in the pres-

ence of acute corneal ulcers obviously is contraindicated.

In the second group of cases, complicated by advanced pyogenic membrane of long standing, the decision between excision and drainage is one of surgical judgment. Excision, notwithstanding the annoyance of epiphora, often furnishes the best results. If the sac condition is not of too long standing and the mucous membrane is not too seriously involved, drainage is to be preferred to excision. Sac obliteration by chemicals is rarely indicated.

Chronic nasal pathology is a contraindication to drainage through the nose. Even in normal sac conditions, one is confronted too frequently with serious corneal and other ocular complications, because of chronic pathology in the nares and sinuses from which pathologic processes extend to the eye through the lacrimal drainage system. If, in addition to nasal disease, the sac becomes seriously involved, it is better surgical judgment to practice excision of the

sac than to drain through a diseased sac into diseased nares.

The three contraindications to drainage into the nose include a not inconsiderable number of cases. Obviously, prolonged and, in some instances an annoying epiphora may be a necessary end-result in the interests of the safety of the eye.

When, however, one may safely choose between excision and drainage, the latter naturally becomes the logical choice. Having decided upon the practicality of drainage, the interesting question, which, in a measure, is academic in character, arises: Shall it be from without in, an open operation, or an intranasal procedure?

Naturally, the problem has an ophthalmologic side and a rhinologic aspect. The ophthalmic surgeon is handicapped, in that he is apt to be inclined to do his own surgery, and is hardly qualified to follow the intranasal route as dexterously as a skillful rhinologist. It is most logical to discuss this problem purely from the standpoint of good surgery, which would include finished surgical technique, accuracy and permanency of results, and absence of scarring. The nasal route is free from external scarring, but on the other hand, in

The nasal route is free from external scarring, but on the other hand, in my experience, the linear scars which follow the external incision can rarely be called objectionable. In fact, in many instances, when the incision is properly placed, the resulting scar is of little consequence.

Dr. West has practiced his operation so often that the technique, in his hands, seems to be very simple and easy in execution. I am anxious to know, however, from other rhinologists, who have not performed the operation so often, as to what their experience may be in the difficulties encountered, and the permanency of results. After all, one must judge of the value of an operation by the consensus of experience of a fair number of capable surgeons. Either type of operation must be judged by end-results, but also by its adaptability to be used by the average operator.

The eye surgeon, who is accustomed to the exacting precision of eye surgery, finds either satisfactory excision of the lacrimal sac, or drainage into the nose by one of several methods not without their difficulties.

From the standpoint of efficiency and permanency of results, either the Toti-Mosher operation or that practiced by Dupuy-Dutemps and Bourget are most satisfactory. The latter may offer greater permanency, in that the mucous membrane of the sac is united with the nasal mucosa. I have found the Toti-Mosher entirely satisfactory and believe that the external route is best for the ophthalmologist to follow. If the oculist is not a surgeon, and refers his case for operation, it would seem to me that either route may be followed by competent men with equally good results.

competent men with equally good results.

DR. MACKENZIE: To some of those who may not know it, I want to say, Dr. West is considered the world's foremost exponent of this subject. Furthermore, I believe he has proved beyond doubt by his masterly presentation and the photographic illustrations that he is master of his subject.

I have never performed this operation but propose doing it in the future when the occasion is presented. On two cases I operated in a crude way through the nose, entered the lacrimal sac and passed a Bowman's knife through the lacrimal process of the inferior turbinate bone and then bit out a quantity of bone on the nasal side where the Bowman's knife presented. Strange as it may seem, this operation proved satisfactory in both cases. Being interested in the eye as well as the nose and throat, I was quite anxious to see and hear this demonstration.

We are fortunate in having Dr. Peter with us to present the ophthalmological side. I have seen quite a large number of cases of dacryocystitis, some with and some without fistulas, in which the tear-sac was supposed to have been removed, when it was found that it had not been removed.

The involvement of the tear duct and the sac comes about through an inflammatory involvement of the mucous membrane of the nose and it seems but logical to attack the problem by the nasal route. We also find cases in which the ophthalmologist probes the tear duct and is able to pass Salsmann's No. 8, No. 9 and even No. 10 Bowman's probe. In spite of which the patient continues to have epiphora. Prof. Maximilian Salsmann, pathologist of the eye, pointed out years ago that cases of the kind exist, because of hyperplasia. When that hyperplasia has replaced the cavernous plexus between the

bony canal and mucous membrane lining, a No. 10 probe may pass, but the patient continues to have trouble.

It seems to me that the most logical thing to do is to attack the problem

through the easiest and safest way, and that is through the nose.

DR. BRAY: I really have very little experience in this particular line. From the theoretical point of view, it would seem to me that drainage through the nose is the rational treatment. My own experience is limited to this line and I believe it is limited to everyone here, with the exception of Dr. West and Dr. Peter. I believe that Dr. West is probably right, that the proper way to operate is through the nasal route. I am very grateful I was here to hear Dr. West.

As for fistula, with the cases of fistula I have never had any trouble. I had one protracted case at the Jewish Hospital, where the diagnosis of fistula of the maxillary sinus was made. We probed through the fistula, cauterized it with carbolic acid and it healed, after other men had treated it for two

years. I believe excision of fistula is better than drainage.

Until you develop a man with perfect technique in this nasal operation, I fear we ophthalmologists will stick to the older methods of surgical procedure. Dr. Babettr: I am afraid I came to this meeting in rather a cynical mood. When Dr. Yankauer first demonstrated his operation for dacryocystitis in Philadelphia some years ago and illustrated this with careful models, the operation seemed simple and I attempted it on a few cases. My vast experience of twelve cases seems amusing beside the 1,700 reported by Dr. West. I did, however, work earnestly and carefully enough to arouse some interest among the ophthalmologists in Philadelphia and was invited to discuss the method at Pittsburgh.

Mr first case was a double one, in which the ophthalmologist and I spent long periods together in operation. This patient was from Hazelton — an elderly lady. We spent about two hours on each side at different times, and continued observation of the case for a couple of years. Finally she had a reasonable recovery but I had some doubt as to its future. Two weeks ago, at the Lankenau Hospital, a lady came to me and asked if I remembered her; she said she was this same Mrs. W. and, to my surprise, 15 years later, at 79 years of age, she was possessed of two good eyes and a good nose, though our postoperative intranasal appearance was anything but favorable.

This was a wonderful demonstration. I should have liked to have studied one or two of the technical slides for a longer time. Those who have tried Halle's operation for ozena and atrophic rhinitis in the nose realize that such intranasal surgery is difficult, though apparently easy. Dr. West is to be very

much complimented upon his fine demonstration,

DR. LAESSLE: I noticed about 21 slides, and out of the 21 there were four on the left eye and three on the right. Is there any special reason why one

side should be affected more than the other?

DR. West, in closing: Perhaps Dr. Peter misunderstood me, for it seems to me that we agree completely on what should be done in cases of diseased tear-sac and in cases of ulcus serpens. We both remove the entire tear-sac (the specimens demonstrated show that). However, Dr. Peter operates from the outside through a facial incision. I do the same complete resection of the

sac intranasally and avoid the facial incision,

Then, too, the internal operation results in a dry eye, since the nasal drainage is restored. The external extirpation of the sac leaves the patient with epiphora. In other words, I do just what Dr. Peter does, and then more besides. He removes the sac externally and leaves the patient with epiphora. I remove the sac internasally, thus avoiding an external incision, resect the entire sac, re-establish drainage from the eye into the nose. The restored nasal drainage removes the bacteria from the conjunctiva, and leaves the patient with a dry eye.

EASTERN NEW YORK EYE, EAR, NOSE AND THROAT ASSOCIATION.

Regular Meeting, Jan. 20, 1932.

Observations in Adenoid and Tonsil Surgery. Dr. David H. Jones.

From May 1, 1929, to Nov. 1, 1931, 32,303 patients came to the Manhattan Eye, Ear and Throat Hospital complaining of symptoms referable to adenoids and tonsils; 27,849 operations were performed, making an average of 960 patients per month. Three deaths occurred during this series; one in 1929 from ether narcosis (adult); second in 1930 from heat prostration (child); third in 1931 from status lymphaticus (infant, age 20 months).

It was felt that the need of better supervision and more careful work was necessary to accomplish good results. With this in mind, a history card was devised, in which we endeavored to use a form which would require very little extra labor. Every defect is checked on this card, making it possible at any future time to give one a mental picture of condition before, during and after operation, by merely glancing at the card.

The next step was to select the proper assistants who would co-operate in this reorganization. It has been proven without a doubt that the care taken in the wise selection of assistants has been most beneficial.

A distinctive colored history card is used in the Tonsil Service. On the patient's first visit, the reasons for operation and description of condition are noted by the tonsil surgeon, and checked on the card by the clerk. Patient is then sent to the office, where a future date for operation is given.

On the morning of admission a complete physical examination is given, including urinalysis, to all patients requiring either local or general anesthesia. Patients with any of the following conditions are not admitted for operation: Temperature over 100.4°; sugar or albumin in urine; acute inflammation of tonsils; immediately following peritonsillar abscess; female patients within the five days previous to monthly period or five days during period.

The history card accompanies the patient to the operating room, and on it is recorded the name of the operator, anesthetist, kind of anesthesia used, time of beginning and end of operation, method used, i. e., snare, Sluder, etc. Also number of ties, hemorrhages, pillars torn, uvula missing, and in addition all defects occurring during operation are noted.

The following morning patients are examined by either the tonsil supervisor or a member of the house staff, and defects are checked and initialed in red; if there are no defects, card is initialed in blue.

One week after operation patients return for another examination, being seen by a member of the Tonsil Service, thus enabling the tonsil surgeon to see patients prior to operation, during operation and postoperative. Since this regulation has been in force, out of 7,079 patients operated upon in the past six months, 5,902 have returned postoperative, which is a much larger percentage than formerly.

On the reverse side of the card is a follow-up system which enables one to check up on patients three months after operation,

Reasons for Operation: Frequent sore throat, 92 per cent; frequent colds, 91 per cent; mouth-breathing, 75 per cent; enlarged glands, 65 per cent; otitis, 19 per cent; cardiac, 4 per cent; rheumatism or arthritis, 9 per cent; epistaxis, 5 per cent; quinsy, 5 per cent.

Uniform hemorrhage records are kept in each ward, using the following form:

Name		Address	· Age		Cl. No.
Clinic	Dr. MacKenty Dr. Smith Dr. White	Operator Dr. Checked by Dr.	Date and tim		
	Dr. Faulkner		A.M.	P.M.	
Right	Upper Middle Lower Met	Clamp Aden Tie hod Plug Suture Removal	Plug oid Remova piece	3	st hemorrhage and hemorrhage and hemorrhage th hemorrhage th hemorrhage
Left	Upper Middle Lower	Patient's c	ondition]	Good Fair Poor	

A record of each surgeon's work is kept. All defects occurring during operation are called to his attention, and he is requested to use more care in the future.

The daily average of operations in August, 1930, was 59, and with few exceptions no surgeon was required to do more than 20 operations in one afternoon, as it was found that more hemorrhages and defects occurred later in the afternoon than at the beginning.

Before each operation the surgeon selects his instruments, placing them on a sterile towel on a draped Mayo operating table which is over the patient's body. Any further instruments required are passed to him by the instrument nurse, who anticipates what instrument is wanted next. As the preparation of the tie or ligature occasions much comment, a description follows: a tube of catgut No. 2 is broken and cut into four equal lengths, and at one end a knot is made, the other end being passed from backward forward through the loop, and a clamp is attached to the short end of the catgut. The second nurse, who alternates with the first, has charge of the suction, and at the termination of the operation gathers up the used instruments in a towel and takes them to another room, where they are scrubbed and then placed in a sterilizer. The third nurse, being in charge of the operating room, removes the instruments from the sterilizer and records the work done on the history cards.

Surgeons, anesthetists and nurses wear sterile gowns and rubber gloves. A sterile towel is fastened to the front of their gowns and is changed after each operation.

The right index finger is passed into the nasopharynx, breaking up any adhesions from the side toward the center. The adenatome is placed in the center of the nasopharynx, lifting the instrument as high up as possible so that the adenoid tissue will be inside the box, cautioning the anesthetist to extend head, blade is then closed, instrument is removed and emptied. Next, place instrument along right side of nasopharynx, holding it at an angle away from Eustachian orifice, close blade, remove and use the same procedure on the left side. Palpate for any remaining adenoids and, if found, remove. With few exceptions, three introductions of the adenatome, as outlined, will remove the adenoids, then rub the posterior wall of the nasopharynx with a gauze sponge in a sponge holder; insert plug. The next step is to remove the right tonsil, then insert into tonsil area a plug of gauze or dental roll cut to fit and attached by a thread. The same technique is followed when removing left tonsil. Now remove plug from right fossa and inspect for bleeding points, using a separator to lift anterior pillar while anesthetist holds tongue depressor; clamp and apply ligatures. Remove adenoid plug and, lastly, plug from left fossa, stopping any bleeding with ligature, so that when patient leaves the operating room fossae are dry. As one patient leaves the operating room, another is wheeled in.

We cannot emphasize too strongly the fact that every patient is placed in the prone position with the face downward immediately at the door of the operating room, which position must be assumed in bed. Many nurses place the patients on their back, allowing the bleeding to go on unsuspected, and if the nurse is inexperienced, her attention is called to the difference between bright red and dark, grumous blood regurgitated from the stomach, also close observation of the thyroid cartilage, indicating swallowing of blood and a rapid, thready pulse. In one of our hemorrhagic patients it was necessary to give a blood transfusion, due to the lack of these observations by the nurse.

Hemorrhages are controlled in the ward, but in eight patients who were extremely obstreperous, it was necessary to return them to the operating room, where an anesthetic was administered and bleeding promptly checked. Flagg laryngoscope is kept in each operating room for immediate use should tonsil become detached from instrument and surgeons are instructed in its use.

Operations under local anesthesia are performed by members of the house staff in the local tonsil operating room, accommodating seven patients in the sitting posture, and for the past six months three patients daily were given a hypodermic, morphin grs. 1/6, hyoscin grs. 1/300, one-half hour before operation. Criticisms and suggestions were requested of the staff as to benefits derived. The practice is now discontinued as it was more difficult to manage these patients in a sitting posture. Anesthetic used was 1 per cent procain with suprarenalin. Snare and dissection is the choice of operation.

Any bleeding occurring after patient leaves operating room is called a hemorrhage, whether it is one hour or 14 days later. All hemorrhages have been recorded in this series, some where there was only a slight oozing being checked by the use of silver nitrate and a plug of gauze, others requiring the use of a clamp or tie, and still others suturing pillars. Hemorrhages occurred more from the middle of the right fossa than from the left.

During the past year five patients required blood transfusions. Will mention one of the cases: A boy age 15 years, came to the hospital in July, 1931, with a history of being a bleeder; coagulation time, 12 minutes. Calcium lactate was ordered for him, which he took continuously up to the time of operation on Sept. 15, coagulation time having come down from 12 minutes to 10 to eight and to six minutes. Operation was performed Sept. 15; at 7 and 10:15 o'clock same night two hemorrhages occurred; 500 c.c. of blood was given on Sept. 16, and from sixteenth to twenty-first there was slight ozzing. On the twenty-first another severe hemorrhage occurred; 500 c.c. was given on the twenty-second; another hemorrhage on the twenty-third; the twenty-fourth, he was given 350 c.c. of blood. There had been oozing continuously from both fossae, and the patient at the time of fourth transfusion was pulseless and nearly moribund; on the twenty-fifth, 620 c.c. of blood was given, and on the twenty-eighth, 500 c.c. of blood. No bleeding occurred from the twenty-fourth to twenty-eighth. This patient made a complete recovery; credit being given to the number of blood transfusions given.

For the past six months 15 patients had two hemorrhages; five had three hemorrhages; three had five, and one had eight. One patient returned to the hospital with hemorrhage from the right fossa 14 days after operation, another patient returned after eight days.

Pulmonary abscess following tonsillectomy was noted in eight patients, but as this is a special hospital, patients with symptoms of cough do not return, although they are given a slip requesting them to come back if they have any symptoms of cough,

From Oct. 21, 1930, to Nov. 15, 1930, 475 letters were sent; no replies from 230. From Nov. 24, 1930, to June 9, 1931—56 days—25 per day—1,400. Patients came, 351. Letters answered, 280. Letters returned, wrong address, 140. No response, 829. Answers, 280; favorable, 238; unfavorable, 42. Patients came, 351; favorable, 301; unfavorable, 50.

Jan. 1, 1931, to March 10, 1931; Patients came, 144. Letters answered, 293. Wrong address, 88. No reply, 325. Patients satisfied, 396. Dissatisfied, 41.

Utilization of Tonsil Clinics for Developing Bronchoscopic Orientation. Dr. Arthur F. Holding.

It is hard to get enough experience in the smaller cities and clinics so as to be able to do fast, skillful work in the emergencies when bronchoscopy is indicated. There is an urgent need for otolaryngologists to get more experience in doing bronchoscopy so that muscle sense is trained, orientation is

natural and one works without strain.

In the largest cities there are well trained bronchoscopic teams who keep in constant practice on patients, dogs, rubber phantoms and other devices, but for the busy otolaryngologist in cities of the second class, and smaller communities, who may find himself called upon to do bronchoscopy occasionally, it is necessary to invent ways to keep himself bronchoscopically conscious.

The trend of the time is for intubation and decanulation to be done by the

pediatrician, so this experience is lost to the otolaryngologist.

In order to get bronchoscopic experience at the Memorial Hospital, Albany, N. Y., we have endeavored to utilize our tonsil clinic as a training ground for bronchoscopy. Not having any trained "head-holder," we early came to rely upon laryngeal suspension for delicate operations on the larynx, trachea and bronchi, and accustomed ourselves to sitting at the patient's head and doing tonsillectomies in this position.

We use the Sluder method as modified by Beck, or the dissection method in the manner described by Crowe, for taking out the tonsils. Regardless of what method we use for the removal of the tonsils, we use the Crowe position for the removal of the adenoids, removal of any small pieces of tonsil tissue, removal of lingual tonsils, control of bleeding, application of ligatures, inspec-

tion of field, etc.

Later we adopted the Hasslinger head-rest with the suspension mouth gag as used by Crowe, the ether being pumped through a cannula in the tongue depressor. If the operation is a short one, we hold the gag by hand; if the operation is to be prolonged, we use the vertical and horizontal supports of the Lynch suspension apparatus as recently reported by Whitney in 8,000 cases of tonsillectomy.

Later the technique of intratracheal anesthesia, as devised by Flagg, was adopted in the Tonsil Clinic at the Memorial Hospital and used in all head cases. The general surgeons are beginning to use the same method in head,

neck and chest cases.

The experience of exposing the vocal cords by direct laryngoscopy in a large variety of cases, and slipping a cannula through the larynx into the trachea is valuable to the bronchoscopist.

A great bete noir to the small town bronchoscopist is the savoir faire with which men of the Jackson school flaunt the fact that with a bronchoscopic

team no anesthetic is needed in children.

In the small town there is no trained bronchoscopic team that the otolaryn-

gologist can assemble in an emergency bronchoscopy.

By the adoption of avertin as an anesthetic, we have diminished shock, eliminated all terrors of anesthesia from parents and patients, and insured in the occasional bronchoscopist the savoir faire that he can get the bronchoscope between the vocal cords without any delay, and without any struggling

of the juvenile patients.

The author claims no originality but urges the adaptation of these several well known methods in the common operation of tonsillectomy, and their rou-tine employment to the end of acquiring bronchoscopic orientation for the operators, assistants and nurses in tonsil clinics. The actual insertion of the bronchoscope is not advocated in every tonsil case, but every step of bronchoscopy up to the insertion of the bronchoscope can be done on every tonsil case with benefit to the operator's bronchoscopic orientation and to the patient because a more thorough inspection of the field postoperatively is assured.

Besides these advantages of operation and anesthesia in tonsillectomy, we and our assistants, both doctors and nurses, become oriented to the "head on' position in doing operations about the throat, become accustomed to quickly doing a direct laryngoscopy and intubation by the direct method, all of which are fundamental to good bronchoscopy when the emergency arises which

requires it.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Oct. 9, 1931.

Dr. Douglas Wood, President, Presided.

The Origin of the Temporal Bone and Its Associated Ossicles as Found in Man, and Its Deviations Found in Lower Forms. Dr. John C. Brown.

Dr. John C. Brown, retiring President, gave an address on "The Origin of the Temporal Bone and Its Associated Ossicles as Found in Man, and Its Deviations Found in Lower Forms." Numerous lantern slides of colored drawings were used to illustrate the talk.

DR. RICHARD E. SCAMMON, Dean of the Medical Sciences at the University, had been invited to open the discussion of Dr. Brown's address.

Dr. Scammon said that the discussion of a paper like the one this evening appeals particularly to one who is interested in both biology and medicine. Earlier in history, most of the great biologists were also medical men, and it seemed to him that papers like the present one illustrate a return to the close association of clinical medicine and biology occurring in the present decade.

Several things had interested Dr. Scammon very much in this discussion. In the first place, it brings out the point that the auditory apparatus in man consists of certain parts which are remarkably constant and that along with these are other parts of the auditory apparatus that are as variable as any other parts of the body. Thus the dimensions and form of the auditory ossicles are remarkably constant, while no part of the body is more variable than the extent, size and arrangement of the mastoid cells; yet they are a part of the same apparatus and one naturally turns to ontogeny to attempt to explain this peculiar relation.

Dr. Brown has pointed out that the three parts of the temporal bones are united at birth, that the fusion of those three parts begins a short time before birth. This fusion of the three parts probably goes on for a period of five or six years; unntil that time one is apt to encounter a number of slits and clefts in the petrosquamosal suture.

He stated that Dr. Brown had also pointed out the variance of opinion that exists regarding the ossification of the petrous portion of the temporal bone. Perhaps the explanation lies in the peculiar way that bone ossifies. Most bones ossify in a very simple way: the cartilage is invaded by a periosteal ring at a definite point and a single ossification center is established. There are a few bones in the body, however, which are first represented by large masses of cartilage, and the petrous portion of the temporal bone is an example of this kind. In these, the vessels tunnel and burrow their way into the cartilage before ossification appears. Then the ossification centers come in showers following these blood vessels. This may be the explanation of the confusion regarding the ossification of the petrous portion of the temporal bone. This may also offer an explanation of the very high degree of variability in the distribution of the mastoid cells, which may date back to the early period of vascularization of the cartilage in the latter part of the third or early part of the fourth fetal month.

Dr. Scammon stated that no bones of the body are more regular in their size than are the auditory ossicles. This early development of the auditory ossicles and their early attainment of maturity has a peculiar effect apparently on the optic capsule. These ossicles grow very rapidly but they are enclosed

in a cartilaginous box at the same time. This cartilaginous box must adjust itself to this growth of the ossicles. The cartilage of the petrous portion of the bone appears to grow very much in the same way as the bone that replaces it; there is a constant laying on of material on the outside of the mass and at the same time there is a constant absorption of material from the walls of the cavity it encloses.

Dr. Brown also spoke of the relation of the gill arches and styloid and hyoid processes. Dr. Scammon stated it was interesting to note the various anomalies associated with these structures; for example, the fact that one occasionally gets a process running from the malleolus and connecting with the styloid process. It would be very desirable, he felt, to have a better knowledge of the development of the styloid process. It would be interesting to work out, by careful studies of the ossification, this process in childhood by X-ray. Also one may find the occasional pressure of cartilaginous masses in the tonsils. These were originally described as metaplastic masses, But more probably, Dr. Scammon felt, they represent vestigial masses from the third gill arch, which may remain in the tonsillar fossa.

Dr. Brown brought out the point that these arches are definitely associated with certain nerves: the first with the trigeminal, the second with the facial, the third with the ninth, and the fourth and succeeding arches with the tenth and eleventh nerves. This early and constant relationship explains the very peculiar distribution of the nerve supply seen in the adult ear. So one finds that the muscles associated with the first arch are innervated by the fifth nerve, and those from the second arch by the seventh nerve. There are also a few curious cases of tics and herpes of the seventh nerve associated with the lobe of the external ear. Here there seems to be an anomaly in which a few fibres of the sensory portions of the seventh nerve come to supply a part of the external auditory meatus and surrounding structures.

Dr. Scammon thought this illustrated how important it is to have a working concept of the development of the auditory apparatus in connection with

its practical application.

These are some of the main points that occurred to Dr. Scammon in listening to Dr. Brown's most interesting discussion of the history of the auditory apparatus.

DR. Erling W. Hansen said he would not presume to discuss the question of embryological development even though he once took comparative anatomy from Dr. Brown. He said the question of otosclerosis is one that has always interested him a good deal and he had also read a good deal about the different theories of the causation of this disease. But it always seemed to him, from the very definite familial tendency toward the specific pathology in the labyrinthine capsule that one finds in these cases, that there must be something back in the beginning of that particular structure that causes these changes. He wondered if Dr. Brown had any theory of his own in regard to that.

DR. Brown, in closing, said he wished to thank Dr. Scammon for coming over, and to assure him that all are glad to see him back in Minnesota again. In regard to the question Dr. Hansen brought up, Dr. Brown said he had been in the same quandary himself; he had thought about it a good deal, and he might say shut up about it. He could not help but feel that there is some relation that is present, as heredity, in the development of the individual. He had tried in his own mind to associate some of these pathologic conditions that one finds in the ear. In his studies he had run into a good deal of pathology in the ears and sinuses of the lower animals, and his own feeling was that there is something in the developmental ancestry of the individual which is at fault. As to the explanation of it, he was frank to admit that he did not know anything about it.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

SECTION OF OTO-LARYNGOLOGY.

Meeting of Dec. 11, 1931.

Dr. Douglas Wood, President, Presided.

The regular monthly meeting of the Minnesota Academy of Ophthalmology and Oto-Laryngology was held at the Minnesota Club in St. Paul on Friday evening, Dec. 11, 1931. The meeting was called to order by the President, Dr. Douglas Wood.

Unusual, Bilateral Facial Paralysis. Dr. C. W. Rucker.

Dr. Rucker said this case seemed worth while bringing to the attention of the Academy, because it presented the unusual condition of partial paralysis of both sides of the face from two different causes.

Last August, an 18-year-old boy had come to him, complaining of weakness of the muscles of both sides of his face and of a slight discharge from both

ear canals.

Five years previously, after a cool, rainy week at a Y. M. C. A. summer camp he caught a severe head cold. He had been wearing very few clothes and still remembers how cold he was all that week. He developed an earache on the right side, for which a doctor lanced his drum twice, obtaining little pus. The discharge was never profuse, but persisted for several months. Very soon after his earache, the right side of his face became paralyzed, gradually returning to normal during the next six months. Two years later, without earache, the paralysis recurred. It diminished during the following year, and after that remained unchanged.

During his Christmas vacation in 1930 after a beer-drinking party he had influenza. Before he had fully recovered from it, he, with a group of other boys, walked the streets of their town one evening, singing carols. It was a bitterly cold night, and instead of wearing their usual caps they wore stiff paper hats. From exposure to the cold wind the left side of his face became

paralyzed. Since then there has been a slow improvement.

Since January, 1931, there has been a scant, thin discharge from both ear canals, which he has been treating himself by syringing the canals daily with

an aqueous solution of boric acid,

In August, 1931, when Dr. Rucker first examined the patient, there was a drop of thin secretion in each ear canal. The canal walls were red. Both drumheads were intact and of a deep pink color, and so thickened that no landmarks could be made out. A smear of the aural discharge contained many diplococci, some epithelial cells and a few leukocytes. The picture was that of chronic eczema. He was able to hear a seven-foot watch at three feet with his right ear, and at 18 inches with his left.

X-ray pictures showed the mastoid cells on both sides to be of the pneumatic type, well developed and extensive. On the right side in the region over the lateral sinus and above the auditory canal, there was cloudiness, loss of cell margins and some cell destruction. The Roentgenologist made a diagnosis of subacute mastoiditis on the right, and a normal mastoid on the left.

There was a slight weakness of the muscles of the right side of the face and a moderate weakness of those on the left. The paresis was not so great that the patient could not close his eyes. On the right side of his tongue he could not distinguish sour, salt, bitter or sweet. These sensations were unaffected on the left side.

A diagnosis was made of chronic eczema of both ear canals, and of bilateral facial paresis; the lesion of the right being in the facial canal of the temporal bone and the lesion on the left being peripheral to the stylomastoid foramen, a true Bell's palsy.

In order to refresh any memories that might be hazy concerning the chorda tympani nerve, Dr. Rucker had prepared a simple diagram showing its relation

to the facial. The chorda tympani supplies the sense of taste to the anterior two-thirds of the tongue. Arising in the medulla as part of the glossopalatine, its fibres enter the internal auditory meatus and go through the facial canal almost to the stylomastoid foramen, where they pass through a bony canal of their own to the tympanic cavity. Passing across the upper part of the ear drum between its inner and outer layers, they pierce the temporal bone again and emerge to join the lingual in its course to the tongue, ending in the taste huds

The facial nerve arises at the level of the pons in the floor of the fourth ventricle and courses through the facial canal, emerging at the stylomastoid foramen. It turns forward and ends in the muscles of the face.

In the case reported there was facial paresis and loss of sense of taste on the right, hence the lesion was in the facial canal where the chorda and facial nerve lie together, probably an extension of the inflammatory process in the mastoid cells. On the left, sense of taste was intact, hence the lesion was peripheral to this bony canal somewhere on the face, and was a neuritis following exposure of the face to cold.

DISCUSSION.

Dr. C. N. Spratt stated that many years ago Dr. Reich, of Baltimore called his attention to a French thesis stating that practically every case of peripheral facial paralysis was preceded by an oritis media. Oftentimes this condition is so slight as to cause slight deafness and tinnitus without pain, and consequently would not be noticed by the patient.

Dr. Rucker stated that the patient now is in about the same condition as when he saw him first. The ear condition is improving under treatment.

In reply to Dr. Spratt, Dr. Rucker said he thought the patient would have of taste. The patient had definite history of exposure to cold on the side of of taste. The patient had definite history of exposure to cold on the side of the face. X-rays of the mastoid were negative and he had never had trouble with the left ear.

In reply to the question of location, Dr. Rucker said he did not think the lesion was higher up because of the history in the case; and he was not giving a complete classification of all types of facial paresis, but was only distinguishing between the two types this one patient had.

Four Factors in the Defense of the Nasal Mucosa: Mucin, Cilia, Regeneration and Adaptability (with motion pictures and lantern slides). Dr. Anderson C. Hilding.

Dr. Hilding stated that he is giving this evening a demonstration of four factors concerned with the defense of the nasal mucous membrane; namely, ciliary motion, mucin exchange, power of regeneration, and adaptability of form. The ciliary motion is rapid, powerful and effective. It is not merely a weak "tendency," as has been thought in the past. It is capable of moving loads weighing many grams. A corollary of ciliary motion is found in the overlying mucin film which stretches much like an intact membrane over all the nasal, sinus, pharyngeal and esophageal surfaces. This mucin is the natural medium in which the cilia accomplish their work. Due to ciliary activity, it is changed very frequently (every 10 or 15 minutes) in the posterior twothirds of the nose. It has a definite system of drainage lines along which it These vary between the inactive nonciliated surfaces in the anterior moves. third of the nose and the active ciliated posterior two-thirds.

When surface sloughing occurs, as in the common cold, there may be only a single layer of cells left on the basement membrane, as shown by biopsy. Repair seems to be extremely rapid. In a few days it returns to normal,

Some experimental material is shown demonstrating the changes in the membrane under varying conditions of ventilation. The different forms of epithelium found in the nose can be produced merely by altering the ventilation.

DISCUSSION.

DR. G. E. McGeary said he would like to ask Dr. Hilding a question. He gathered from these pictures that the cilia are very easily forced off by manipulation within the nose, but quickly regenerate. He wondered if this manipulation is continued, so that there is repeated injury to the cilia, if eventually

it would stop them from being reproduced.

Dr. E. A. LOOMIS mentioned an article in the last Archives of Otolarynin which McMurray explained his technique, by plugging up one nares after filling both antra with iodin oil; the one not plugged emptied in five hours, showing the effect of respiration. Dr. Loomis wondered if that corresponded to Dr. Hilding's tests.

DR. W. E. CAMP said he would like to ask Dr. Hilding why certain sinuses are more apt to become infected than others, and also if he believed a metaplasia of the epithelium occurred when squamous cell epithelioma developed

in the maxillary sinus.

Dr. McGeary asked Dr. Hilding what the effect of the Kromayer quartz

light is on the cilia.

Dr. HILDING, in closing, stated, in reply to Dr. McGeary, that the cilia are replaced very rapidly after one or two or half-a-dozen injuries to the surface. If this is repeated persistently, there would be a change in the epi-

thelium, and if the injury is too great one might get an ulcer. In reply to Dr. Loomis' question, Dr. Hilding said he read the article mentioned but that was only a single case, and the man did not co-operate very The results were so at variance with Dr. Hilding's that he thought there must have been some mistake about that particular case. These sinuses cannot empty out any oily solution in five, six or seven hours. And the author made some other statements about the effects of ventilation which Dr. Hilding thought were highly improbable.

Just why some sinuses are infected is probably due to anatomical variations. Dr. Hilding was of the opinion that the size of the sinus has a good deal to do with it, too; the larger the sinus, the greater the exchange of air under varying pressures. The exchange in the maxillaries would be greater than in the ethmoids. As stated in the paper, the effect of gravity is only a handicap,

although most of the time it is not a serious handicap.

Dr. Hilding said he could not answer about squamous cell carcinoma of the antrum. He thought one could not be sure that it is composed of real squamus

epithelium unless prickle cells were found.

In regard to the question as to whether or not one should use a solution in the nose, Dr. Hilding thought as a general thing the less washing there is, the better. A little probably does no harm. Even though one were successful in washing over the mucin, in 10 minutes it will be replaced. On the other hand, someone swimming for two or three hours every day may have all the mucin

washed off over a prolonged period, and get into trouble.

In regard to the action of chronic hyperplasia on the cilia, in this condition the cilia are intact. Dr. Hilding was of the opinion that the antrum with a hypertrophic membrane will still exhibit ciliary motion. On the other hand, when one finds pure pus he may conclude that cilia are gone or badly injured. Dr. Hilding did not mean to say a window will not help drainage. Sometimes it helps a great deal, but there will still be drainage through the ostium. He said he had made no observations on atrophic rhinitis but he had an opportunity to observe a patient whose turbinates had been removed surgically. The patient had too much exposure and the whole inside of the nasal cavity took on this inactive form. In atrophic rhinitis the epithelium gives just this "squamous" epithelium picture. The atrophy is so great that all surfaces are exposed to the impact to cold, dusty, dry air.

OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY OF NEW ORLEANS.

Meeting of Feb. 18, 1932.

Case Presentation. Dr. T. F. Beatrous.

M. M. Y., white female, age 23 years, of Italian extraction, inclined to obesity, was first seen by me, April 4, 1931. Complained of pain over the left side of the face, also pain in the left ear, with swelling in the parotid region. She claimed that these attacks lasted for a few days at a time, subsided and returned at intervals. This condition has existed for the last two years, and only subsided when the swelling over the left side of the face disappeared. During these attacks, she found it difficult to chew and swallow and, therefore, was forced to refrain from eating solid food until all symptoms had disappeared.

Past history was of no significance. Physical examination showed a well nourished but obese female. Height, 5 feet, 8 inches; weight, 166 pounds.

Pulse slightly rapid and temperature 99°.

Examination of head and neck: Face: Left side of face swollen to moderate degree, accompanied by intense pain. Neck short and a fairly good-sized goitre, which seemed to be of nontoxic type. No cervical adenitis present. Mouth and throat examination was made with difficulty, due to swelling and intense pain. Teeth: Seemed to be in good condition. Tongue: Tongue and adjacent structures are normal in appearance. The buccal mucous membrane of the check is injected and seems to be pushed towards midline. The orifice of Stinson's duct is inflamed and elevated. The pharynx is negative, cords and arytenoids are normal to inspection. Nose: Negative. Ear: Negative. Drums clear.

Digital palpation with left index finger placed on the inside of cheek and the right on the outside and over the mass, which I took to be the parotid gland, and with gentle manipulation I thought I could feel a small, hard object, which I interpreted to be a stone. I then applied 10 per cent cocain over the region of the mouth of the duct and proceeded to dilate same. The probe entered the duct for a distance of about three-fourths of an inch and after withdrawing same, a very small amount of mucopus was expressed. An attempt was then made to milk out what was thought a stone at the proximal end of the duct but without results. The patient was then ordered back home and instructed to rest as much as possible in bed and use hot application over the parotid region. About two weeks after the acute symptoms had subsided I again dilated the duct and was able to enter only a short distance with the probe. An X-ray was then made of this region, which showed only one stone in the gland in close proximity to the duct. An operation was advised. operated on her and elected to remove the stone through the mouth. After infiltration with 1 per cent novocain and adrenalin in the area involved, a horizontal incision about one inch in length was made over the region, care being taken not to damage the duct. The large stone which was seen in X-ray was removed by careful and difficult dissection. Much to my surprise, after removal of this stone, I was still able to feel a cluster of stones, which were held firmly together by a fibrous tissue. However, by careful dissection, I was able to deliver seven more stones, making eight in number. The largest stone was about the size of a small pea, the others gradually decreasing in size to the smallest, which was about the size of a pin head. The bleeding was controlled and the incision was swabbed with tincture of iodin and same was left unsutured. The patient was then removed to her bed and a hot water bag placed on the side of the face and a mouth wash was ordered. The patient made an uneventful recovery and has had no similar attacks since the operation.

Case Presentations. Dr. H. L. Kearney.

White male, age 66 years, referred for bronchoscopic treatment of lung abscess. He had never been sick prior to the present illness but had had a cough ever since he could remember. Two years ago he had had his tonsils removed and had not felt so well since, but had not been really ill until three months ago, when he discovered he had temperature of 102°. Skiagraph showed lung abscess of the right lower lobe. At bronchoscopy lung abscess was confirmed, but malignancy was suspected and a specimen of tissue removed for biopsy showed squamous cell carcinoma. The patient was quite toxic from the lung abscess but improved materially from bronchoscopic drainage done at intervals of five to seven days. Bronchoscopic intervals of five to seven days. Bronchoscopic inplantation of removable radon seeds was considered but was not done because gangrene of the lung was feared from the reaction in the presence of a considerable mass of infected lung tissue. Deep X-ray therapy was used instead, and bronchoscopic aspiration of pus continued at intervals.

Any patient between the ages of 40 and 70 years who develops cough and blood-stained sputum should be suspected of having carcinoma of the lung, regardless of whether he may have associated with it a lung abscess or an empyema.

Two cases of nonopaque foreign body of the lung with retention emphysema of the invaded lung were shown. One case was a boy, age 5 years, with a piece of cornbread in the left main bronchus, and the other a boy, age 2 years, with a grain of corn in the right main bronchus. Physical signs in each case showed limitation of expansion, tympanitic note on percussion and absence of breath sounds, all on the invaded side. Skiagraphs made at the end of expiration showed retention emphysema of the invaded lung and displacement on the trachea and mediastinal contents to the opposite side. On inspiration the expansion of the bronchus forms air spaces between the bronchial wall and foreign body so that air may enter the lung, but on expiration the contraction of the bronchus obliterates these spaces and thus traps the air in the lung. The foreign bodies were removed at bronchoscopy; convalescence was uneventful and there was almost immediate return of physical findings to normal. The important point in connection with these cases is that the life of the patient is in the hands of his family doctor. If the history of foreign body is disregarded (and it frequently is), then the child dies of so-called "pneumonia" or "bronchitis."

The family doctor who recognizes these conditions deserves as much credit for saving the patient's life as the bronchoscopist who removes the foreign body.

